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The Temple of Jupiter Olympius at Athens.

IT is understood that considerable trouble has recently been bestowed in examining the foundations and traces of the foundations of the Temple of Jupiter Olympius at Athens. It will probably be some time yet before what results have been obtained are before the world. But it is generally known that the evidence which has been recovered is very scanty, and it is to be supposed, by its very scantiness, likely to be inconclusive. Pausanias speaks of the temple in terms which imply that it was completed and in occupation; he refers to the temple statue, but he gives no architectural detail or description. Stuart and Revett did not doubt that the temple was decastyle. The local Athenian opinion appears now to be verging to a conclusion that it was octastyle. It is to be feared that the excavations will go as little way to decide this architectural problem as did those at Halicarnassus to recover a trustworthy elevation of the Mausoleum. In the meantime it seems worth while and desirable to take an independent survey of the problem, as it comes before us with the literary and other evidence already in possession. We shall thus be better prepared to recognise the points in respect to which any new facts will really touch the true difficulties of the case, and how far importantly or indeed whether at all. In this matter, as in so many others, it is useless to attempt to compare two sets of evidence until each has been thoroughly tested independently.

The passage of Vitruvius which has every appearance of referring to the Temple of Jupiter Olympius at Athens, has been a sore trial to the commentators. The manuscripts give a variety of readings to choose amongst, and these have been supplemented by a variety of tentative corrections. But turn where you will, says Schneider, you are beset by incongruities, and he decides at last to print the text, supported by the most numerous manuscripts, without professing to be able to make consistent sense out of it. This appears to be one of the cases in which we are driven to resort to general inferences from the evidence at large as to what the writer must have intended to say, though his words, taken as we have them, would be little better than nonsense. "I think my cousin meant well," says Justice Shallow, and he acts accordingly upon what, no doubt, is a correct interpretation of Slender's muddle between "dissolutely" and "resolutely"; we have to deal with Vitruvius here on the same principle. "The hypæthral temple, then we read, is decastyle in pronaos and posticum; in all other respects it agrees with the dipteral temple, but in the interior it has columns in double height, at a distance from the walls, for a walk all round like the porticos of peristyles. But the middle part is open to the sky, without a roof, and there is an entrance portal at either end in pronaos and posticum. There is no example of this at Rome, but an octastyle at Athens and in the Olympian temple."

To deal first with what is comparatively clear; we are justified in ascribing to the author a statement that the typical hypæthral temple, in accordance with its name, had its central area open to the sky, but surrounded by an interior colonnade giving a covered passage all round. This varies from the arrangement with which we are familiar in the Parthenon and other temples, where the colonnade in the covered naos is not returned at the side of the entrance. That this colonnade was in two stories was no peculiarity of the hypæthral temple, as the form of expression, perhaps from mere carelessness, seems to imply; but corruption rather than carelessness must be implied in the text, which goes on to define the hypæthral temple as properly decastyle, and to cite an octastyle as an example.

But here comes in the question, did Vitruvius intend to refer to one temple or to two,—that is, to a proper type and an exception? The text is ambiguous, and no proposed emendation suffices to make it better. It seems to be a case for an heroic remedy. We have to deal with a passage jostled out of joint, and to get the articulations into place we must jostle it again resolutely and vigorously without much regard to the sequence and collocation of the members as they are presented to us. What we may then get may accommodate the meaning that "there is no example of a decastyle temple at Rome, but there is one at Athens, and an hypæthral hexastyle at Olympia." This implies a wrench, but it is only by a violent and painful wrench that a serious dislocation can be reduced.

Otherwise there seems nothing for it but to interpret "there is no hypæthral temple at all at Rome, but Athens has one, an octastyle, that is the temple of Jupiter Olympius," and Vitruvius must be answerable for omitting to give a decastyle example after stating that the rule demanded one.

Vitruvius assigns the commencement of the Athenian Olympium to Pisistratus, and gives the names of four architects as concerned with it; Aristotle refers to the sons of Pisistratus, who succeeded to his power, as going on with it in pursuance of the usual policy of tyrants, of which he cites other examples, to occupy the "unemployed" subject population on vast architectural works. We must assume that the project at this date was for a Doric temple. Antiochus Epiphanes is then recorded as undertaking to continue the work of which the foundations, at least, had been commenced; this was about 150 B.C. He employed a Roman architect whom Vitruvius credits with the design of the now familiar and fashionable Corinthian order and dipteral. He classes it for magnitude and magnificence with the temples at Ephesus and Miletus, and the Telesterion at Eleusis. Antiochus did not complete it (Strabo, p. 364). In 86 B.C. Sulla captured Athens, and carried the columns of the Olympium to Rome for the temple of Jupiter Capitolinus; he may have taken away comparatively few even of those already erected, but, in any case, when Vitruvius wrote,—in the time of Augustus,—the temple was unquestionably in a state of ruinous incompletion. A number of kings got as far as a scheme to combine and complete it and dedicate it to the genius of Augustus Cæsar, but the sycophancy did not advance beyond verbal expression. It was reserved for Hadrian, more than a century after Vitruvius wrote (A.D. 117–38), to complete and dedicate it, and also the statue of the god which was seen in it by Pausanias.

Considering the state of the temple at the time when it was known to Vitruvius or his informants, it is not unlikely that he may have been in some confusion respecting it. And at a later date it is not to be considered impossible that Hadrian may have completed the temple upon a less enormous scale than it was originally laid out for. It may not then have been hypæthral at all, as, indeed, there was no need, with a contracted width, that it should be.

Assuming, then, provisionally, that the temple was octastyle, the top step would measure,—by Revett's dimensions,—135 front : 354·2 flank.

The addition of an equal margin of 5·5 ft. for the projection of steps would produce an oblong plan of 146 : 365 ft., exhibiting the simple proportion of 2 : 5.

This is the same proportion which was adopted for the lowest step of the temple at Bassæ, which was unusually narrow,—that is, unusually narrow for its length.

The two steps of the Parthenon below the proper stylobate project 4·64 ft., and the assumed margin is, therefore, sufficient for two or three steps, and within very reasonable limits.

The existing remains show a double row of free columns on the flanks, and the walls of the cella would consequently range with the third columns from the angles in front.

The interior breadth of the naos of the temple as octastyle may, therefore, be deduced within very narrow limits of error ; it would correspond with the extent of two diameters of the peristyle column and three intercolumns, plus a certain difference from the thickness of the cella wall being no doubt less than the diameter of a column. Apart from this increment we obtained 45·6 ft. for the breadth of the naos, but the difference in question is as much in the Parthenon as 2 ft., or 4·38 jointly. The columns of the Parthenon differ but little in diameter from those of the Olympeum, and we may assume like agreement in the walls. There is, therefore, no objection to extending the breadth of the naos here to 50 ft., which, indeed, must be accurate within half a foot or so, one way or the other.

This extreme 50 ft. compares with the 63 ft. of the breadth of the naos of the Parthenon.

It is impossible to set aside the statement of Vitruvius as to the, at least the intended, introduction of an internal peristyle. If we proceed upon the analogy of the Parthenon, we shall allow 25 ft., or half the full breadth of the apartment to the clear central avenue, and 12·5 on either side to be divided between the ambulatory and the bases of the columns.

There is, however, no positive reason why the central space should not be increased at the expense of the lateral divisions, and still leave ample space for passage. If it were increased to 30 ft. as against the 32 ft. of the Parthenon. it would leave 10 ft. on either side, which, within half a foot, suffices at Bassæ for the external flank ambulatory and bases of columns, 3·8 ft. in diameter. The limited width thus left for a hypæthral naos seemed to Stuart to be conclusive against an octastyle plan.

We have no guide whatever by which to estimate the probable diameter of the interior columns here ; those of the Parthenon appear to have been about 3·66.

A naos of this span would, of course, be easily roofed ; the case would be different if the decastyle front could be maintained ; this would increase the full breadth of the naos to about 79·60, and present the reasonable appearance that the architect availed himself of the opportunity of widened proportions which the hypæthral arrangement allowed him, when the responsibility of roofing was removed.

After all, the reduction from decastyle to octastyle would only economise 12, or at the utmost, including pronaos and posticum, 18, external columns, out of a total of 118.

To proceed, however, upon the octastyle theory. We are, at least, within the possibilities of the case if we assume that the apartment containing this peristyle had a length of 100 ft. against its approximately certified breadth of 50 ft. This is the proportion of a double square which (1 : 2=9 : 18) is more elongated than 9 : 14, the proportion of the Parthenon plan.

If we assume that the transverse walls of both pronaos and posticum ranged with the fifth columns from the angles we should be left with some 90 ft. of interior length still to dispose of.

From this may fairly be deducted one-half or 45 ft. for an opisthodomos or treasury, and we may, if we please, indulge the supposition that the remainder was given to a covered apartment housing the colossal statue of the God, and that this was seen from the internal peristyle, to which, as unroofed in the centre, the term hypæthral might properly apply.

But the main difficulty of the octastyle arrangement, even exceeding that of the cramped width, lies in the assignment of a height to the naos which shall be consistent with the narrow proportions to which it is reduced.

The inner range of flank columns on the exterior is raised upon a proper continuous stylobate, and it is possible that other steps through the pronaos may have raised the level of the floor of the naos a foot or two above that of the peristyle and front portico. But still the height for the naos, which is left on our hands, is unmanageably excessive, and it was not the way of Greek architects of a good time to waste any space in dead lofts.

Even if the cornice of the interior columns only ranged with the cornice of the peristyle the height from the pavement would not be much less, if at all, than 60 ft.,—as against the 44 ft.,—the utmost that is available in the Parthenon.

This would give a proportion for the central avenue of breadth to height, as 3 : 6, to compare with the 3 : 4 of the Parthenon with allowance for utmost possible height.

It is by no means easy to perceive how the difficulty of such an improbable proportion is to be evaded.

It will be observed, moreover, that the lateral colonnades of the naos must nearly range with the two central columns of the portico, and would, therefore, be under a much higher part of the general sloping roof than those of the Parthenon, which range with the third not fourth columns from the angles.

These difficulties do not present themselves under the conditions of a decastyle which would accommodate a reasonable proportion of breadth to height in the central avenue, and of which the breadth would reasonably account for its being uncovered by a roof,—as the fact of a roof not being demanded by the theory of the dedication would account for the unusual breadth which it was possible to indulge in.

The decastyle temple would allow a fair 80 ft. for the full breadth of the naos, and the assumed length may then be plausibly extended to 120 ft., giving a proportion on plan of 2 : 3,—the naos of the Parthenon being 9 : 14, and the proportions would approximate as closely as $\frac{27}{42} : \frac{28}{42}$.

Deduct allowance for the aisles, 20 ft., as before, and we should have height=breadth for central area (60 : 60).

This result is at least more consistent than that which the octastyle theory appears to commit us to inevitably. The presumption, therefore, remains that the Corinthian temple from which Sulla carried off columns was planned to be decastyle, though Hadrian may have contented himself with completing it as octastyle.

It is observed by Kinnaird in a note to his republication of Stuart and Revett's Athens (vol. iii., p. 91) that the Corinthian capital (plate xxiv.) of the upper order of the Arch of Hadrian "much resembles in the foliage and execution that of the great temple near it,"—that is, the temple of Jupiter Olympius. The justice of the remark will be obvious at once on comparison of this plate with Penrose's careful drawing of the larger capital. The apparent differences are scarcely so considerable as might have been expected from the difference of scale,—2 ft. compared with 6 ft.

The agreement in execution argues even still more strongly than that of detail in foliage, for the same date for both capitals ; and we are thus justified in assigning to the architect of Hadrian the columns of the great peribolos. Had the execution varied importantly we might have entertained the notion that the smaller columns of the monument inscribed with Hadrian's name were copied from the others, for which an earlier date would then have been to seek.

The properly Classic school of ancient sculpture comes to an end with the years which produced the statues and busts of Antinous, the favourite of Hadrian. The technical merit of these would be quite sufficient to warrant the survival of architectural decorative sculpture, though we did not possess the positively dated remains. It is probable that the true Classical architecture died out as suddenly and completely as the sculpture. It is more interesting to scrutinise what we have of the productions of this its last period for any signs of the approaching corruptions of the style, and still more for indications of how, when it should be thoroughly broken up, free play might be asserted for some motives and influences which were already uneasily asserting themselves.

Such indications are not wanting ; we have columns employed as mere decorative adjuncts, standing free in close proximity to a wall, and responsible solely for supporting a segment of the entablature, which is only advanced above them as matter of decoration again, or at best to have the appearance of giving them something to do. Still worse, we have columns mounted upon tall pedestals, with independent cornice and base mouldings ; placed as they are between two pilasters which differ in height, they convey an unpleasant suggestion of having helped themselves awkwardly to keep company with the taller companion. This is the combination which offends, but in a different direction, in such façades as those of St. Giorgio Maggiore at Venice, and the church of the Redentore. Here the very much larger columns are on high pedestals, as if with an effort to exaggerate their already manifest superiority, and at the same time they forfeit that expression of stability which is left to the inferior order in having its base mouldings upon the continuous ground line.

The pedestal of the column was duly transmitted through the Romanesque styles to developed Gothic, but in its progress took forms which divested it of all its objectionableness. We may trace it at Canterbury, Wells, Westminster, and endless instances. It was harmonised by changes which deprived it of the independence which the classical pedestal seems to assert or be capable of asserting ; it was shorn of the cornice, which in itself implies an intention of definite conclusion ; its section was made conformable, or approximately so, to that of the column above, if not circular polygonal,—and generally it was reduced from an important member, supporting the independent column or shaft, to a series of offsets or mouldings entirely subordinated to it, blending with the base mouldings above, and at most forming a transition to the plain plinth below.

In this arch of Hadrian we also observe a faint approach to the conceptions for a distinct pier, and a pier combined into a whole with attached columns.

The pilasters which support the central arch have proportions which are not unsuitable, as seen in front, to somewhat shorter columns with rather depressed Corinthian capitals ; but the mouldings of these capitals are returned under the archway and crowned by a modification of the same foliage, where the thickness of the wall enforces a proportion quite unknown to the ordinary anta.

The same applies to the larger pilasters at each extremity of the building ; the breadth in front and at back is increased beyond the usual proportions of an anta, as it is returned at the end.

These variations in themselves are by no means unpleasing, in fact quite the reverse. They are varieties which were spontaneously induced and which more enterprising and less fettered architects were destined to cultivate to some purpose.

The plan of the upper order presents two semi-columns engaged at either end of an oblong pier and a square pilaster attached to it intermediately on one side. The plinth and mouldings of the Attic base of the Corinthian columns are continued to the pier and so all round, but the foliage of the capitals of columns and pier are not connected by any carved treatment of the intermediate plain core to which all are attached. At the same time this is crossed by the lines of the abacus and of the astragal below the capital. Here, again, we come to a cross-way where Mediæval architects join hands with Classic. It was for the future age to take the decisive step of closing up the composition and so making it truly such, and when this was done to evince appreciation of the invention by pressing on to all its capabilities of variation either for beauty or appropriate employment, and so endowing

architecture with all the resources of the compound pier and clustered column.

Finally, in this building we see the distinct precedent for those who might have the sagacity and taste to take the hint and the courage to pursue it, of an archivolt, with the simple mouldings of an architrave made to spring directly from the abacus of a capital. With marked consistency the archivolt is carried up so high that its upper moulding falls into line with the corresponding moulding of the horizontal architrave above it. In the well-known design of the courtyard of Diocletian's palace, at one end an arch is sprung from the capitals of the columns of the entrance, but frieze and cornice are bent over it as well as architrave; at the side arcades, another heavy architrave is repeated above that of the archivolt which rises from the free columns.

The Ionic order attached to the aqueduct of Hadrian at Athens presents still another and a very significant variation. A wide intercolumniation of an Ionic portico is here spanned by an archivolt which springs from the continued horizontal architrave,—the frieze and cornice, awkwardly enough, abutting upon it, but with mouldings profiled. This is the earliest hint of a sequence of developments. In the Dome of the Rock at Jerusalem we see one form which it took. "There the architrave is cut off so as merely to form a block over each of the pillars, and the frieze and cornice only are carried across from one of these blocks to another" (Fergusson, 280).

This block becomes ornamented in what may be called the super-abacal block of the capitals of the Church of SS. Sergius and Bacchus (Fergusson, 853), and in time had come to overpower the decorative capital.

In the West it had a somewhat different fortune; more or fewer of the mouldings of the architrave were often retained in type, at least, but the plain spaces were abbreviated; in this form the member becomes too flattened to be called a block, and assumes the appearance of an addition of mouldings to the normal abacus. In this form the metamorphosed Classic architrave may be recognised in many of the Romanesque churches on the Rhine, at Cologne, and elsewhere. No particular excess of beauty accrued to it in this form; but the accumulation of forms may have had its influence in stimulating the remodellers of the style to exercise their ingenuity in combining an extraordinary variety of combinations in their more elaborate capitals.

Thus we trace back the general relations of forms as if following successive generations in a pedigree. But our pedigree has to be traced conjecturally; for it comes to us in accidental fragments. It is rash, if not absurd, to suppose that we can point to a variation in a particular building as the first example of an anomaly, and that from which all similar deviations were lineally derived. It may have had far more notorious predecessors; it may have been the first in time, but nevertheless have been overlooked or neglected till the occurrence of another under more conspicuous circumstances produced, or was one of those that produced a permanent impression. Still,—with these considerations allowed for,—the preserved instances are producible in evidence, and the study of their affiliation cannot but be instructive.

PROGRESS OF LOCH KATRINE EXTENSION WATERWORKS.

AT several special points between Loch Katrine and Glasgow the extension operations (primarily noticed in the *Builder* of June 13th, 1885) are found in certain stages of progress, although a vast amount of work remains to be overtaken, and the date of completion is yet a great distance ahead. The largest outward show of activity is discerned, perhaps, on the site of the new service reservoir now in progress of construction alongside the old one, contiguous to the termination of the tunnel aqueduct at a distance of about 7½ miles to the north of the city, and flanking one of the chief turnpike roads which lead from the south over the Highland line. The Act for Craigmaddie Reservoir, by which name it is to be known, was procured so far back as 1882, and the works have been a long time under way. When finished it will cover an area of nearly seventy acres, with a capacity of 700 million gallons, and enclosed by a somewhat irregular boundary-line, part of this line being furnished by an angle of the embankment, which secures the old reservoir, whose capacity stands at 550 million gallons. Huge embankment works were entailed in this Craigmaddie scheme, which is by far the boldest of its kind in Scotland, and it is upon preparations for these that operations have chiefly centred, although the progress thus far made, under contract, has not at all been such as to satisfy the controlling engineers of the Corporation. This massive earthwork is to extend to nearly one mile in total length, traversed centrically from end to end by a puddle wall of uncommon resisting strength, the trench for which cuts to great depths from the higher lying surfaces, down through softer strata to a rock bottom of a satisfactory closeness of grain and consequent imperviousness to the infiltration of water. The embankment itself cannot be said to have been touched as yet, but the huge trench is laid open along its full length, and an approved bottom has already been come upon at several points, although on no section has the filling in of the clay as yet commenced. Right at the bottom the trench is found on the section of its greatest width, gradually narrowing upwards to a measurement of 14 ft. at the top, for the greater part through freestone, with a surface covering of unstratified rock and gravel, and at the most formidable bit of cutting attaining a depth of 130 ft. from the crest of the ridge above. Clay in sufficiency is to be had on the ground within the boundary, and of excavated stone more than enough for all the masonry and ballasting necessary. To shield the trench works from water inundation during the process of making and clay packing, it became necessary to impound by temporary embankment certain interior surface waters, and to lead these off under careful regulation across the great cutting to the outside of the bounds. This was accomplished successfully, and clearance is being constantly effected by a rock-cut discharge culvert measuring 5 ft. by 4 ft., delivering into the Allander Water, a tributary of the Kelvin, this culvert being destined for permanent retention in order that by means of it the reservoir may be emptied when necessary. The ordinary outfall into the pipes which are to carry the stored water into Glasgow will have position at a lesser depth, or about 60 ft. below the surface of the dam, the maximum of which is to be 90 ft., attained at a heavy outlay in excavation over almost the whole area. Powers had been taken also to alter somewhat the route of the public highway above spoken of. This has been some time effected, and the new portion of roadway, six furlongs in length, and heavily embanked in one of its sections, will on the completion of the whole work form a not unimportant backing to the lofty water embankment which it adjoins. The dam will be of irregular shape, at greatest 1,000 yards across from north-west to south-east by 500 yards on the broadest line at right angles to this, and exclusive of a measuring pond 320 yards in length, situated at the corner nearest the tunnel mouth. From this measuring pond to the outfall or outcrop of the tunnel by which the loch water is conveyed, the distance is fully half a mile, necessitating a connecting aqueduct which will be partly in tunnelling and partly in open cutting. Commencement has not yet been made on this aqueduct.

The main tunnelling under the mountain ranges separating Loch Katrine from the Clyde valley, for the formation of a second and larger aqueduct from the loch, is being prosecuted under a later authority, namely, the Act of 1885. This, owing to the configuration of the territory, naturally divides itself into three sections, of which two are in progress. That lying nearest to the city makes approach in an almost due southerly direction, cutting under the range between the Blane basin and what may be called the basin of the Kelvin, — betwixt which latter point and Glasgow the engineering features are altogether commonplace in character, being confined for the most part to a multiplied subsoil piping. The new tunnel cuts into the side of the hill at the north end of the existing reservoir (Mugdock), occupying exactly the same level as the old tunnel, and running parallel therewith at a distance of 66 ft. to the east, and on the same south dipping gradient of 10 in. to the mile,—a relative position which is kept by the work throughout. From Mugdock reservoir northward to the outcrop above Blane Water is a direct distance of 2,674 yards, the loftiest point of the undermined hill, which is a spur of the Kilpatrick range, rising 250 ft. higher than the levels of the bores. This section is being pierced from either end, on the two faces only; and, contrary to the mode adopted when the old tunnel was made, there are no auxiliary working shafts sunk from the surface of the hill aloft. The boring drills are worked by compressed air conveyed from the open in pipes, a system which, along with other advantages, such as comparative speed and greater economy and simplicity of calculation, possesses the primary one of furnishing a ventilation of the most efficient kind, by means of the abundant air constantly set at liberty from the drilling machinery. In measurement the new tunnel is 12 ft. wide, with a height of 9 ft., as contrasted with the 8 ft. diameter round bore of which the older work is composed; the drills work from a carriage frame on rails, and, after the firing of each blast, ballast-wagons of a reduced size, running on the same rails, enter the works and carry away the *débris*. The work goes on with the utmost regularity,—monotony, it might almost be called,—and it is continued in shifts night and day. At first the road lay through a deposit of shale (a poor sort, and quite unworthy the attention of the oil distiller), but whinstone was quickly come upon, and whinstone it is almost certain to remain the entire passage through. From Mugdock end the length by this time pierced is about a quarter of a mile; the northern mine is more advanced, being fully double that distance forward, and operations as now proceeding will be continued till the two gangs of drillers meet deep under the ridge. This work is interesting as the first sample of its kind in Scotland, and the engineers reckon with confidence on an almost mathematical accuracy of result. The driving of the northern end is done almost entirely free of annoyance from water; there is rather more of in-leakage at the southern face, but even here is found but the smallest ground for complaint; and one fear entertained at starting has so far proved groundless,—there has been no intrusion of straggled water from the neighbouring tunnel; not a drop so far, and the chances now are that there will be none. Progress made on this portion of the extension works gives great satisfaction to the engineers, and the completion of it is confidently looked for before midsummer of next year. Of the other two sections of tunnelling farther to the north and nearer Loch Katrine, that of Kelty is the only one upon which a start has been made. A contract for the Duchray portion has been assigned, and it will be attacked at an early date. The whole of the works comprised within the two Acts of 1882 and 1885 are under the personal direction of Mr. James Gale, C.E., the chief of the permanent water corporation staff.

NOTES.

OUR contemporary, the *American Architect and Building News*, has apparently been misinformed as to the attitude of this journal in regard to the question of the registration of architects, in respect to which we are entirely dispassionate, and which we are prepared to consider fully at the proper time, but not at the suggestion of a few persons representing nobody but themselves, and who have endeavoured to push themselves into notice at the expense of the really

representative body of the profession, by dint of impudent and systematic misrepresentation. The last example of the tactics of these people is referred to in the letter from the Secretaries of the Institute of Architects, printed in another column, and calling attention to the fact that the persons in question have, in accordance with their former tactics, sent round to architects a circular inviting signatures to a petition in favour of their Bill, so worded as to induce the unwary to think they represent the Institute of Architects, to which, in fact, they are acting in direct opposition.

THE leading article of the *Economiste Français* for the 28th of January, which is signed by the Editor, M. Paul Leroy-Beaulieu, is devoted to the Panama Canal. The writer especially turns his attention to the recent change in the proposed level of the waterway through the Cordilleras, and to the time which, in his opinion, must be necessarily consumed in the execution of this reduced scheme, if the money now asked for, which amounts to 22½ millions sterling, should be forthcoming. Admitting, for the sake of argument, that the estimate now put forward of 40 millions of cubic mètres of excavation is adequate for the canal with locks, M. Leroy-Beaulieu shows from the data published by the *Bulletin du Canal Interocéanique* that the work executed in the summit cutting during 1887 was not more than from 1,380,000 to 1,400,000 cubic mètres; and that as it would be necessary to excavate at least 12,000,000 cubic mètres in this section, even for a high-level canal, the work would occupy at least from eight to nine years. He deduces from the past accounts that the cost of this work cannot be less than 20 francs per cubic mètre, and adding the annual charge of 73,000,000 francs for interest, concludes that, even if the work could be completed in five years, 1,565,000,000 francs must be found to pay for it. M. Paul Leroy-Beaulieu speaks in the most unhesitating tone, but his previsions are based on the accounts published by the directors of the canal in their annual reports and bi-monthly *bulletins*. In the *Economiste* of February 4th M. Leroy-Beaulieu concludes his study of the prospects of the Panama Canal. On January 28th he dealt with the question of capital; in the second article he investigates the possibilities of income. He concludes a minute examination of the sources of traffic, which were indicated in 1879 by M. Levasseur, of the *Institut*, whose figures have been always brought forward by M. de Lesseps, by stating the result that if the canal could be opened in five years from now, from 4 millions to 4½ millions of tons might pass through it, if it were on the level, and if the charge were not more than ten francs per ton; but that this tonnage would be reduced to from 3 millions to 3½ millions of tons if the canal were constructed with locks. He states that 215 millions of francs per year would be required to pay the stipulated interest on shares and bonds, and to maintain and work the canal if open. In arriving at these figures he has estimated that from 1,000 to 1,100 millions of francs must be raised in order to complete the canal on the reduced plan. Since the publication of this estimate it has transpired that the company are applying for the authorisation of a lottery loan for 775,000,000 francs, or three-quarters of the sum named by M. Leroy-Beaulieu. In the face of an income so much below the needs of the case, M. Leroy-Beaulieu concludes that the only possible resource for the company is to suspend the payment of interest on the shares; to reduce that on the bonds to 2½ per cent. on the money actually advanced, not on the nominal amount of debt; and to apply to the Great Powers of Europe to guarantee 3 per cent. on a further loan of from 40,000,000*l.* to 44,000,000*l.* Failing this guarantee, he says that France must renounce a ruinous dream.

SOME unexpected, if not unprecedented, incidents of water supply practice have been noted during the past dry season, which it may be useful to mention. In the case of a town where a copious supply is obtained by pumping from a gravel stratum, which is generally regarded as the channel of a subterranean stream, there was no falling off in the quantity of supply. But the water, though generally clear, was so unusually charged with salts dissolved from the soil, as to lead to stoppages in the smaller pipes. Much anxiety was excited, as it did not at first occur to the engineers that the low state of the springs, and the possible effect of that condition on the subterranean chemistry affecting the water, might be the cause of trouble. But with the autumn rain, although not very copious, the trouble disappeared. Another observation refers to sanitation; effluents which had given much trouble from their offensive character, having in some instances ceased to flow. This fact, if for the moment it was a welcome one, is not to be overlooked. With a return of anything like a normal rainfall no doubt the flow will recommence. But whether it may be less or more pure from the temporary absorption of a daily flow by the soil is a question which it will require careful observation to settle. At all events, it is clear that numeric observations of the inflow and outflow of water into pervious or quasi-pervious strata during the past, and, indeed, the present, year, will require careful corroboration before they can be accepted as final. In one place where the drainage of more than 20,000 people is now said to be swallowed by the soil without yielding any visible effluent, it will be especially needful to be on the look out when the land springs are again in activity.

THE indications of an unpleasant shortness in the water supply of 1888 are far from satisfactory. Rarely have the springs been so low as was the case during last summer and autumn, and the rainfall of the winter months has done but little to restore the balance. The best authority as to British rainfall speaks of his entire inability, without aid in calculation such as he should not be allowed to ask for in vain, to even guess at the hydraulic conditions likely to prevail during the next six months. Liverpool at this moment is on a short supply, and is looking to her future with no little anxiety. On Lady Day, 1886, which is the latest date to which public accounts come down, Liverpool had incurred a loan debt (exclusive of sums paid off by a sinking fund) of four millions sterling for waterworks alone, out of a total municipal debt of 7,920,000*l.* The population of the borough of Liverpool in 1881 was 552,500 persons, out the out townships which share the supply then contained 164,500 more; and the annual rate of increase during the preceding decade was more than 1 per cent. More than 775,000 persons are thus concerned in the prospects of the Liverpool supply. Above one-third of the daily supply, which in 1882 was 16,000,000 gallons, is required for trade purposes, so that the domestic supply, under exceptionally good engineering arrangements, is only about 14 gallons per head. Thus, Liverpool has been at the same time prescient and munificent in providing for the supply, and careful and economical in the distribution of this prime necessary of civilised life. The streams of the Vyrnwy will, no doubt, hereafter supply the wants of this great commercial capital. But if Liverpool is now in want, what is likely to be the case in many places in the ensuing summer, unless we have weeks of steady rain?

THE *Bulletin de Correspondance Hellénique* (xi., 6th December, 1887) contains a valuable paper by M. P. Paris on the terra-cotta exvotos found in the recent excavations at the Temple of Athene Cranaia, near Elateia, the progress of which we have noted from time to time. The paper is accompanied by three heliographic plates giving some of the principal types of the exvotos. In style they are thoroughly Tanagrean, and, as Elateia is not far from Tanagra, it seems likely that they were actually made at the great Tanagra "fabrique." Their chief interest lies in the fact that they re-open the great "Tanagra terra-cotta" question. These terra-cottas were found, it will be remembered, in tombs. They were at Tanagra part of the funeral furniture of the dead man; hence much ingenuity was exercised in finding for them a ritual signification. Here at Elateia the very same figures, some obviously cast in identical moulds, are found as exvotos in the temple. Obviously this re-opens the question of significance. It is not the first time terra-cotta exvotos have been found in and near temples,—at the Erechtheum and the Asklepieion, the Temples of Artemis Agrotera at Athens, of the Dioscuri at Delos, Zeus at Dodona, and countless other examples, have been found, but in such fragmentary and scattered condition that they have not been made the object of systematic study. The splendid and complete instances unearthed from tombs have eclipsed the modest exvotos of temples. A careful study of the exvotos in the Elateia temple leads M. Paris to the following conclusion, based, we may say, on the examination of some hundreds of instances:—1. The exvotos of the temple are often identical with the offerings of the tomb; they get their meaning, funereal or religious, from the place of their deposition. 2. The exvotos do not represent as a rule either the particular god or goddess worshipped, or an object peculiarly pleading to this deity. They represent rather some object pleasing to the taste of the worshipper, and therefore acceptable as a sacrifice,—"tout le prix de l'offrande est dans l'intention."

TWO or three weeks ago (see p. 60, *ante*) we called attention to the accidental discovery of the famous sanctuary of the Kabeiri in Bœotia. Excavations were then just beginning; already news comes that a speedy harvest has been reaped. First, as regards topography, the walls of the temple have been made out, a few shattered columns have come to light, a door, two altars, and a trench filled with the bones of sacrificial victims. There has been an immense "find" of votive offerings, consisting of animals sacred to the Kabeieroi; so far they are uniformly oxen. 500 have been found made of terra cotta, 74 of bronze, 1 of bronze gilt, 83 of lead. Many of the bronze specimens are inscribed. There is much in this discovery to remind the excavators of Olympia. There, it will be remembered, some hundreds of bronze votive horses came to light. We keep the most interesting discovery to the end. The fragment of a black-figured vase has been found decorated with the figure of a bearded man seated in a chair; he holds a cup to a boy, who is about to fill it from a wine-pitcher. The scheme recalls the British Museum Exekias vase, with Dionysos and Oinopion, but above the head of the man is written *κάβειρος*, the first instance, if we are not mistaken, of this deity on vase-paintings. Our account is taken from the *Berliner Philologische Wochenschrift*, February 4th. The same paper briefly reports fresh discoveries on the Acropolis that promise to be of the utmost importance. Some fragments of statues of porous stone have come to light, between the east end of the Parthenon and the Acropolis Museum, which are of distinctly earlier date than even the earliest of the torsos discovered last year. One fragment is of a life-sized statue; all the remains are brilliantly coloured. They are stated to be the earliest specimens of Attic sculpture so far known. Further particulars will be eagerly looked for.

A STRIKING experience as to the durability of *papier-mâché* is reported as observed in Germany by *Kuhlow's Trade Review*. Since 1881 the German railway authorities have used a certain number of wheels made of layers of thick paper, which have been compressed by powerful hydraulic pressure. They have been chiefly applied to passenger carriages and sleeping cars, some of which are provided with breaks. At first the excellent results which had been reported from America were confirmed, and no accidents which could be attributed to the failure of the material occurred. But in December, 1886, a passenger carriage left the line in consequence of the complete

collapse of its wheels, made of paper. It looked as if some structural change had occurred in the material. A diligent investigation was set on foot and numerous instances were found in which the wheels showed signs of injury, the periphery of the paper discs being in most cases burst. These injuries were found to have chiefly occurred in wheels which had been subjected to the action of breaks. The extraordinary part of the case is not so much that a material so different in its structure from a true metal should be disintegrated by the violent and continued jar of a wheel under a break, but that these wheels should have run for nearly four years before this destruction occurred.

THE advice given by Lord Stanley of Preston to the deputations from the Mining and the British Iron Trade Associations at the Board of Trade, on a recent occasion, does not lead to the idea that the Government have grasped the main points which their resuscitated Railway and Canal Bill proposes to settle. "Settle your disputes, gentlemen," said his Lordship, "while they are in a condition to be settled with comparatively little friction and difficulty." Good advice; if only a principle of settlement were indicated. The Bill, the deputations urged, ought to prohibit station terminals. But the companies seek to enforce them. Foreign produce, the deputations argue, ought to be put on the same footing as British produce. "Yes," reply the companies, "we are willing to agree to that, except in cases where we cannot get the foreign produce to come on our lines without reduced prices." But this is to beg the very point in dispute. And not only so, it admits that the companies can carry British produce at lower rates than they now charge,—if otherwise it would not come on their lines. This is not business. Is it honesty? That traders should be all charged alike, and that they should have the same through rate facilities as the railway companies grant to one another, is a proposition of such elementary justice that it seems incredible that it should be necessary to ask it. Yet these are the points as to which the "searching criticism" of the House of Commons will, Lord Stanley hopes, tend to the advantage of the measure.

THE veteran archæologist, Professor Heinrich Brunn, is embarking on an undertaking from which many a younger man might well shrink. He is about to bring out with accompanying text a chronological series of monuments of ancient sculptural art under the title, "Denkmäler Griechischer und Römisher Sculptur." The work is to consist of eighty parts, each containing five plates,—these parts are to appear at intervals of from three to four weeks. It is to be published by Friedrich Bruckmann, of Munich. Its price, when complete, 80*l*., will for the most part limit its possession to public libraries. If the fulfilment comes up to the promise the possessors will, however, have good value. The work is to be prepared on the basis of entirely new photographs of monuments in the various European Museums. To personally superintend the technical details of the production of these photographs, Dr. Leopold Julius (well known for his work in connexion with the Ægina marbles) is commissioned to visit all the principal museums. The plates will be in permanent phototype, and will not exceed 12 in. by 16 in. in size. The text, we regret to see, is to be in German only. In a work like this, which, if adequately carried out, should be of the utmost use to amateurs and artists, as well as to professional archæologists, surely, as in the case of the great Sabouroff publication, the alternative of French might have been offered. The text, Dr. Brunn states, will have for its object not so much to describe the plates as to justify the selection and grouping adopted. We shall hope to notice the first number on its appearance.

IT appears that there was to be a meeting of the General Committee in connexion with the Liverpool Cathedral scheme yesterday (Friday) in order to receive a report from the Sub-Committee. The latter was previously published in the Liverpool papers, and is not very hopeful. The "three courses open" are:—(1) To abandon the idea of a new cathedral altogether, and to be content with St. Peter's church. (2) To give up the site in St. John's Churchyard and to be content with a small cathedral in some other position. (3) To adhere to St. John's site and to apply for a new Act, in the hope that contributions may yet come in enabling a large cathedral, like one of the competitive designs, to be built. The Sub-Committee recommended the second course, seeing no use in adhering to the St. John's Church site, to which many persons have objected; and if Liverpool is to content itself with a small cathedral, only a large church, the St. Peter's site is perhaps the best; the St. John's site demands an important building. By the time these words are published, however, the Committee will probably have decided on their course, unless the discussion should have been adjourned.

THE building for the Glasgow International Exhibition is now in a very forward condition, being practically finished in all except the detail and finishing work of the interior. At the south-east corner stand the fireproof quarters destined for the fine-arts section, and here also the progress made has been most satisfactory. Every inch of exhibition space within the structure, inclusive of the machinery annexe, has been allotted, and there is over and above a large force of belated applicants for room who have been left out in the cold. Much of the structural activity has, by this time, transferred itself to the outside of the building and spread over those portions of Kelvingrove Park which have been set aside as the "grounds" of the Exhibition. On the north the Bishop's Palace is being expeditiously put together, although as yet offering but little suggestion as to what the finished appearance is to be, and here also a good start has been made upon the fountains. The deepening of the Kelvin is well advanced, and the trenching necessary for transferring a sewer outfall of that river (having place at present immediately below the building) away down out of the way to the Clyde, is under active progress. A good many of the exhibits are already housed.

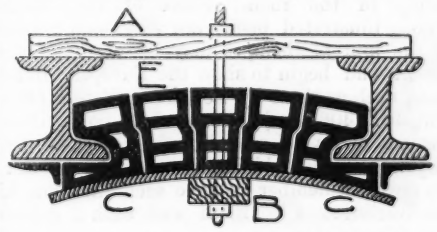
THE London and North-Western Railway Company are about to erect large premises at Westminster. We also observe that they carry forward in their account a very large sum to the next half-yearly account. Under these circumstances it is difficult to understand why the directors do not set to work to improve Willesden Junction Station, which is one of so much importance to the metropolis. The station for high-level suburban trains is a mere shed, of the most inconvenient kind, and a perfect disgrace to the greatest railway company in England. The departure platform for the low-level Croydon trains is unprotected and without waiting-rooms, and the staircases and approaches are of the most inconvenient sort. Certainly Willesden Junction should have been taken in hand before the offices at Westminster were begun; the neglect of the company to do so is quite unaccountable.

SEVERAL years ago the managers of the Royal Lunatic Asylum at Morningside (an important asylum of its class) acquired Craig House, an ancient manorial residence, which adjoins the grounds attached to the original buildings. The situation is a very fine one, commanding an extensive prospect, and the ground is well stocked with fine old trees. Upon these grounds the managers have resolved to erect a model asylum, provided with every modern improvement, the cost of which is estimated at about 60,000*l*. Mr. Sydney Mitchell is the architect appointed. Morningside was, at no remote period, a suburb of Edinburgh, but now it is absorbed in the city, which is even extending beyond it to the south and west. The parish church was enlarged several years ago by the addition of a chancel and transepts, and now again a further extension is to be carried out by adding side aisles, enlarging the chancel eastward with an organ-chamber, and prolonging the nave westward. Messrs. Hardy & Wight are the architects, their design having been selected from amongst others in a limited competition. The church, which is at present seated for 730, will, when added to, accommodate 920. But even this extra accommodation will not suffice for the parish, and a new church is to be erected at Nile-grove, to the southward, where, in the meantine, an iron church has been provided.

THERE occurred these words in a lease:—"All rights and appurtenances . . . . except rights, if any, restricting the free use of any adjoining land or the conversion or appropriation at any time thereafter of such land for building or other purposes." More than twenty years after this lease was granted, and the house erected on the demised plot of land, the owner of the adjoining land obstructed the light to what we call the demised house. The question arose whether these words fell within the words of the third section of the Prescription Act, and showed that the light had "been enjoyed by some consent or agreement expressly made or given for that purpose by deed or writing." But the Court of Appeal held that this was not so, that the words of the deed were to enable the landlord or any one claiming under him to obstruct the light before the statutory period, and to prevent him being stopped from so doing on the ground that he was derogating from his grant. But as soon as the lessee had enjoyed the light for the statutory period then the right was indefeasible. There was, in fact, no express writing giving the lessee an enjoyment of the light. The case, which is that of Mitchell *v.* Cantrill (27 Law Reports, Chancery Division, p. 56, February No.), is thus interesting, not as throwing light on these particular words, but as showing the necessity in a deed for the use of clear words lessening a lessee's rights if it is intended that they shall be abbreviated.

SOME correspondence has appeared in the *Standard* of this week in connexion with the digging up of old water-pipes, of wood, in Piccadilly, and at the Temple Bar end of the Strand. Mr. Andrews sends to our contemporary some extracts from the Hertford municipal records to show that in 1769 were furnished "thirteene feet of elm pipe at 1s. 8d. per foot, and iron hoops"; and in 1776 some men were paid "for boring 66 feet at fourpence per foot." In 1814 the Corporation resolved to lay iron pipes in future.

THE new buildings for Mr. Whiteley have been got up with wonderful speed, and seem likely now to make a good stand against fire. We visited them a day or to ago specially to look at Doulton's fireproof floor as applied here, and which is, in some parts of the building, still in course of construction. It forms a very workmanlike type of fireproof floor, solid, and not too heavy, and it leaves a finished flat roof all over the building, which ought to be of some practical value as so much space. The subjoined sketch may serve both as a reminder to our readers of the nature and construction of the flooring, and as an explanation of the



manner of building it. The flooring consists of flat arches of hollow terra-cotta lumps, between iron joists about 3 ft. 6 in. apart, these joists, of course, resting on iron beams, which are also covered up from the direct action of fire. The terra cotta skewbacks are made with a deep slot to fit over the lower flange of the iron joists. The method adopted in setting the terra-cotta arches is this:—Although they are left as flat arches, it is desirable that they should be built with a small camber, and left to settle when centres are struck. To do this easily and effectually, without any elaborate centering,

thick pieces or wood (A) are placed across from joist to joist at intervals of a few feet, and a piece of the same scantling (B) is supported longitudinally beneath these by screw-bolts at about the depth of the lower surface of the flooring. Thin planks (C, C) are again laid transversely over B, and after the skewbacks are got in, the screw is turned so as to pull up B and bend C into a slight curve (purposely exaggerated in the sketch), and the remainder of the blocks are then set on the upper side of these planks. When the mortar is set, it is only necessary to unscrew B from A, and the whole centering comes down. A key-block of the terra-cotta is left out where the bolt works till the moment when the centering is removed, the adjoining courses giving the necessary support to the blocks. After the whole has settled, the space E is filled up with concrete and finished with a smooth face.

THE collection at Burlington House, Illustrating the history of engraving in Japan, is a large and apparently representative one, and there is no doubt a good deal of historical and characteristic interest in it, but in the main a study of the collection seems to show how utterly artificial and foolish is a great deal of the enthusiasm got up about Japanese things in the present day. To hang up these collections of ill-drawn grotesque figures all round a room, and talk solemnly about "schools" and "styles" in regard to a set of things which are only like the efforts of clever children to draw figures, is too absurd. The impression from a wood engraving of the thirteenth century, No. 1 in the catalogue, hideous as it is, is very interesting as an early example of "wood-chopping," showing that the intuitive endeavour of the early engraver was to get his effect in the easiest manner, by cutting lights rather than by leaving lines; the face, indeed, is nearly cut out, leaving a black outline, but much of the rest of the figure is done simply by scoring the block with furrows. After this, and one or two other early engravings, there is a gap till we come to 1700, when the series of wood blocks stamped in various colours,—chromo-printing, in fact,—come into notice. The lines of drapery are fine and sweeping in these, and every now and then we come on a figure which is characteristic without being utterly absurd; but these are the exceptions, and these would only just pass in European work as fairly drawn, but your Japanese collector is ready to go into raptures over things that would be condemned as puerile in European art. A few bird engravings shown are, of course, fine,—Ginsetsu's "Falcon," for instance (No. 48); and it seems from the "Roadside Scene" (58) by Hokusai that the Japanese are sometimes better figure artists in the preparatory drawings made for a wood block design than they are in the finished and coloured-up work. This example is in reality a cartoon for a block, made on thin paper and then intended to be pasted down and the thickness of the paper scraped away and the lines incised into the block. This work is far superior as a group of figures to most of the things in the room. Some of the things among illustrated books are very good; some of the best of them, it may be observed, are recent, and begin to show the European influence, such as those by Yeitoku in Case I. (404, 405, 407, 408, &c.). Some of the flower illustrations in Case J are admirable, but as to the majority of the exhibits we can only say that we never remember to have seen the room in the Burlington Club filled with such a collection of ugly things.

The London and North-Western Company's New Works in Hampstead-road.—The London and North-Western Railway Company are about to construct new works in Hampstead-road, including, we understand, an extensive new goods depôt and several large warehouses. For the purposes of the intended works several properties have been purchased, including Mornington Chapel. A valedictory service was held in the chapel last week, preparatory to the building being taken down. The Company's works are to be at once commenced.

ROYAL ACADEMY LECTURES.

Mr. G. Aitchison, A.R.A., the Professor of Architecture, concluded his course of lectures on "Greek Architecture," on the evening of the 9th instant. His second lecture was on the general arrangement of Greek temples, which, he explained were on the model of a square-sided oblong hut, with vertical walls, and a span roof with gable ends. At first with a recessed porch, with the bressummer supported by two posts, and afterwards surrounded with a verandah. Plans of nearly all the published temples were given to a uniform scale. He gave a quotation from M. C. Garnier, advocating the study of the ruins of Greek temples, and their restoration on paper, and wound up with the theory that the peculiar arrangement of the columns of the naos of Apollo Epicurius at Bassæ, which has not yet been accounted for, was to resist the thrust of the stone roof.

His third lecture was on the lighting of Greek temples; he controverted the old hypæthral theory, *i.e.* that the naos was wholly unroofed, and showed that Vitruvius's theory of decastyle temples being open, which included the octastyle one of Jupiter Olympius at Athens, was deduced from this temple, and from that of Apollo Didymæus at Miletus, being left, in Greek times, unroofed from want of funds. He admitted that the temples to the five deities mentioned by Vitruvius, viz., to Jove, Lightning, the Heavens, the Sun, and the Moon, probably had hypæthræ, or an unglazed skylight, and exhibited some Italian drawings of the Pantheon at Rome as an example. He mentioned the marble curb to surround an opening discovered by Professor Cockerell at Ægina, and quoted M. Chipiez's opinion that there were two hypæthræ, one on each side, over the aisles of the Temple of Jupiter Panhellenius, and that the nave was lit, as by a clearstory, from between the upper row of internal columns; this opinion was confirmed by the colouring found by M. C. Garnier. He also mentioned the tiles found by Baron Haller to surround an opening or openings in the roof at Apollo Epicurius, at Bassæ. . . . . He showed that those who claimed an hypæthron for temples to other deities but those mentioned by Vitruvius, for instance, for the Parthenon, had at least Vitruvius's silence against them. The authorities of the South Kensington Museum had lent Fergusson's model of the Parthenon to exhibit his theory, but the light of the room was not favourable to its proper display.

In his fourth lecture, on the Doric order, he gave a sketch of Vitruvius's work, his claims as an authority on the methods pursued by the Greeks in setting out their temples, and suggested the possibility that St. Paul had read the treatise of Vitruvius. He showed that Vitruvius's setting out of the triglyphs in temples, as far as the text is understood, would not work. According to Jocundus, the intercolumniations are right, but the metopes unequal. According to Schneider, the metopes are equal, but the intercolumniations wrong. He showed that the Roman Doric, unfluted, with a base, and with a kymation cap, was probably derived from the Greek: the kymatic cap, from examples like that at the Agora at Priene; the unfluted columns from the Greek unfinished ones, which in some cases may have been so left for tapestry. He adverted to the part played by tapestry in ancient buildings, as described in M. Louis de Ronchaud's work on the subject. The base was probably copied from very early and late Greek examples; he also adverted to the new theory that the base of the column in the Treasury of Atreus was a proto-Doric cap. He spoke of the superiority of Doric temples to all others, both from the contrast of the triglyphs to the long horizontal lines of the architrave and cornice, and to their acting as a foil for sculpture; to the much greater study bestowed on the Doric order for sunshine effects, and wound up with a slight sketch of the polychromy of temples, and a suggestion that it might be tried on the new school at Athens.

In the fifth lecture he treated of the Ionic and Corinthian orders, and of pilasters. In the Ionic he mentioned Herr Puchstein's theory, that the modelled cap was first introduced by potters in terra cotta from the painted wood ones, after terra cotta had been used to cover the wood entablature. He explained M. Hittorff's theory, deduced from paintings on vases, of the wooden origin of Doric and Ionic columns, and spoke of the proto-Ionic lately found outside a rock-cut temple in Phrygia. He spoke of the ultimate solution of the meaning of the *scamilli impares* of Vitruvius by the English architects of this century, the right translation of the passage by Wilkins, the observance of its occurrence by John Pennethorne, and its ultimate investigation and settlement by Mr. Penrose. He recommended the writing of a monograph on the Corinthian capital by some learned English architect, on the lines of that on the Ionic by Herr Puchstein.

The sixth and concluding lecture touched on those buildings of the Greeks about which at present we are almost in the dark. He spoke of the harmonic vases in the theatres, and gave the fourteen Greek modes, and explained that the Gregorian modes were the tunes of ancient Greece. He gave a sketch of those two wonders of the world,—the Mausoleum and the Artemision. Of the former, he accepted Mr. Pullan's restoration of the pyramid and Pteron, but showed that no proper solution has as yet been given of the chamber discovered by the Knights of St. John when they destroyed the Mausoleum in 1522 according to Guichard, and mentioned N. Hawksmoor's solution of the mausoleum, in the steeple of St. George's, Bloomsbury; and he exhibited Mr. Pullan's restoration, as well as the beautiful drawing of Professor Cockerell's restoration, by the late F. P. Cockerell; he adverted to the refusal of the Government to publish a properly-illustrated book of Mr. Wood's discoveries at Ephesus, with a complete text, showing that without the full documents and particulars the public were kept in ignorance of what might turn out to be the true solution of the Artemision, as well as in total ignorance of the other valuable information obtained in the theatres, &c., excavated by Mr. Wood; and wound up with an extract from Xenophon's "Memorabilia," where a famous wrestler said he could tell his pupils by their bearing even when they went to the shambles for meat. So he hoped that the future buildings erected from the designs of Royal Academy students might be known by their truth, their beauty, their excellent proportion, and the perfection of their details.

The lecturer returned his thanks to Mr. A. S. Murray, to Mr. Falkener, Mr. Penrose, Professor Middleton, Herr Ihne, and Mr. Pullan for architectural and archæological information; to the South Kensington Museum for Fergusson's model of the Parthenon; to Mrs. F. P. Cockerell, to the President, to Mr. Gipps, Professors Lewis and Smith, to Mr. Spiers, and to the Hellenic Society for the loan of pictures, drawings, diagrams, and photos.; to the Guardian Fire Office for their chromo-lithograph; to Mr. Brindley for marbles; and to Sir G. Grove, Mr. Holmes, Mr. Tadema, and a host of other private friends for information, translations, books, and suggestions.

ITALIAN THEATRE REGULATIONS.

The regulations in force in Italy for the supervision and protection of theatres, &c., to which we have previously referred (see *Builder* for Nov. 5 last, p. 627), have been translated and printed by the Metropolitan Board of Works, in continuation of the regulations for theatres in Paris, Berlin, and Hamburg, translations of which have been already issued by the Board. These Italian regulations, as we have already remarked, are of a very stringent character, but they are clear and concise, and present some points which appear to be capable of universal application.

The regulations proceed from the Home Office, Department of Public Safety, and are dated June 17th, 1887, and are signed by the present Prime Minister, F. Crispi. It is, however, worthy of remark that the carrying out of these regulations is left in the hands of the municipal authorities, namely, the prefects and mayors, and that the Government places the whole responsibility on these officers, and merely lays down certain rules for their guidance as to the construction and supervision of places of public amusement. In doing this the Italian Government are only developing that policy which we are accustomed in England to call local management, a policy which has largely contributed to the progress and prosperity of the Italian as well as of other nations. It is left to the prefects, says the Prime Minister in the circular accompanying the regulations, to prescribe the measures and precautions which may be found necessary

and applicable to prevent fires in theatres, the provision of an iron curtain, and so forth, as well as such as seem requisite for the stability of the building. I intend, he proceeds, that so far as regards proposed new theatres the following rules shall be complied with implicitly, as matters of principle which admit of no exception, and that as regards existing theatres they shall serve as a guide as to what alterations should be required after due consideration of the circumstances and what practicable and manifestly necessary in order to avoid accidents.

The fundamental rules referred to by the Prime Minister are the following:—

1. The building shall be entirely isolated on all sides, and shall have exits on each of such sides into the public streets.

2. The pit shall be on the level of the street, or not more than 6 ft. 6 in. above such level.

3. The pit shall have at least three principal exits, one at the back and the others at the sides, each delivering separately into the street.

4. The number of tiers shall not, as a rule, exceed three in number, exclusive of the gallery. If, however, as an exception there be a fourth tier it shall be provided with two staircases and two separate exits. The same rule shall apply to the gallery in any case.

5. A separate exit, leading directly into the street, shall be provided at the back of the stage for the use of persons employed in the theatre.

6. The three tiers of boxes shall be provided with two staircases and two exits distinct from the other staircases and exits.

7. The staircases and exits, as well as the corridors, shall be wide and commodious. The doors of the boxes and the other doors to the theatre shall be made to open outwards.

8. The staircases shall be of stone.

These rules are applicable to all new theatres, and, as far as possible, to theatres which are practically rebuilt.

As regards existing theatres, the Minister enjoins that the prefects should require, after careful survey, such alterations as are practicable in order to bring them in harmony with the regulations prescribed for new theatres, and points out that if a theatre is so arranged as not to admit of the ready exit of the audience, the prefects cannot shelter themselves from responsibility, notwithstanding any alterations which may be proposed, except by making an immediate order for closing the theatre. This may seem a strong measure, but where the public safety is concerned, nothing short of a power of veto of this description can adequately secure the public from danger.

In conclusion, the Minister remarks that if the regulations proposed are strictly observed, he feels sure that though it may not be possible to guard against each and every accident, it will be possible to prevent the occurrence of a catastrophe. The prefects, continues the Minister, in words which in the East would have been written in letters of gold, and are deserving of the gravest consideration, "should bear in mind that although due regard should be had to the private interests of the managers and owners of theatres, these interests should be subordinate to the exigencies for the personal security of the public, and that the end in view,—which is the preservation of life,—should outweigh any consideration as to the pecuniary sacrifice necessary for the attainment of that end."

MAHOMETAN ARCHITECTURE.*

I HAVE now to take up the second part of my subject, which describes in detail some of the decorative features which constitute its architecture, and which, it will be seen, are the natural consequences of the precepts laid down in the Koran, modified by such changes in the progress of the art, and the desire for architectural magnificence, which is the end and aim of the poetical and artistic requirements of mankind.

The treatment of walls is the first subject. In the earlier periods these seem invariably to have been constructed, when in stone, in plain ashlar masonry, the only decoration (excepting the ornament which decorated the openings of doors or windows) being shields, as in the Bab-el-Nasr at Cairo, or symbolic representations of tigers, as in the Gate of Damascus at Jerusalem. In the former of these two gateways there is a cornice, an unusual feature, consisting of a single moulded projection, supported on corbels. Cufic inscriptions, also, in raised letters, in a recessed frieze, are likewise found. When the walls were in brick, as in the Ibn Touloun mosque, and covered with plaster, the necessity for some further decoration than the stuccoed wall presented, resulted in bands of interlaced ornament and Cufic inscriptions. Besides these we find indented patterns, enclosed in a circle, and forming a frieze. Round the upper part of the walls of the court of Ibn Touloun are a series of octagonal panels, with indented ornament, enclosed top and bottom with simple sunk mouldings.

Coming to the thirteenth century we find in the Mosque of Sultan Kalaoon a desire evinced for increased decoration of the walls, and either by means of stones of varied colours or, that failing, paint is employed, either on alternate courses of the stone or in diaper of various kinds. At the present time in Cairo all the red colour on the buildings is, I believe, paint, but in one or two cases I found a dark-coloured stone employed, though whether that must be set down to its having been painted and washed out I do not know. In Damascus, however, the great Khan of the seventeenth century is decorated with alternate bands of black and yellow stone. In the Mosque of Sultan Hassan red bands are employed to emphasise the main constructive features only, as,—the jambs of the great portal, the voussoirs of the great arches inside, and a square panel round the windows.

At a later period, as in the Mosque of Sultan Barkouk and El Ashraf, we find the bands of red alternating in even courses with the uncoloured stone. This is not, however, common to all the mosques, for at a still later date we find them trusting to a decorative moulding, which is the most characteristic feature of the Saracenic style in Egypt. It consists of two beads sunk in the stone with hollow between each, constantly interlacing,—sometimes crossing once and sometimes twice, and then enclosing a hexagon. There is an infinite variety of examples of this decoration in Cairo. Occasionally, as at Sultan Hassan, there is no cornice to a Saracenic building, the roof is flat and a kind of cresting is carried round, which is of the most varied form. Below this is a small string-course of slight projection.

The absence of a cornice is in many buildings compensated for by the introduction of the stalactite corbelling between flat piers or buttresses, which from the thirteenth century are invariably adopted as a method of breaking up the wall surface; in the case of the wall enclosing the mosque proper these buttresses occur about 10 ft. apart, and are carried up the whole height of the building, with windows between lighting the ground and first floor (for galleries exist in most of the mosques).

In Persia (as I have already pointed out) the decoration consists of a veneer of glazed bricks or tiles, broad bands of which surround all the chief features, enclosing the portals and windows in squares. Variety is obtained either by the alternating of ornament and Cufic inscriptions, or by the employment alternately of white on blue ground or blue on white ground, and occasionally the use of other colours, as green, yellow, and red.

In India they adopt similar treatment in brick buildings; in their stone examples sometimes they cover the whole surface in ornament of a similar kind—a process either adopted from Persian models, or a relict of the custom of the earlier Indian builders to cover the whole surface of the wall with sculpture or carved ornament. In work of later date, the walls of white marble were inlaid with an infinite variety of ornament in black, examples of which may have been seen in Verestchagin's paintings of the Pearl Mosque and the Taje Mehal. In Syria the same custom obtains as in Egypt, except that they have a greater partiality for black in the place of red lines. In Turkey the tendency is to black lines of colour and generally of marble.

All this refers to external decoration: when we come to the interior of the mosques and palaces, they revel in every variety of colour decoration, both of material and painted. The columns are of marble and porphyry, the walls, or at least the lower portion of them, are lined with slabs of marble or glazed tiles of infinite variety. The inscriptions above are cut in stone or in plaster, with Cufic characters and interlacing ornaments; as a variety to the plain slabs of marble, we find sometimes, as in the Mosque of Sultan Hassan, and in the Great Mosque at Damascus, panels filled with special designs in inlaid marble, which form a very beautiful series of examples.

All these, however, at first sight pale into insignificance before the painted decoration of the Alhambra, in which gilding forms so important a feature. I confess, however, that this exuberant richness of design, in the plaster work and painted decoration of the Alhambra, palls upon me, and an inspection of Owen Jones's work on the Alhambra and the magnificent court he designed and erected at the Crystal Palace causes me to turn with relief to the simpler, but more real, decoration in stone, marble, and tiles, which is found in Egypt and Constantinople.

The principal decorative features of Mahometan architecture are:—1st, the Entrance Porch; 2nd, the Minaret; 3rd, the open Loggia, which frequently forms the pendant to the minaret; and 4th, the Dome.

1. *The Entrance Porch.*

The Entrance Porches acquire their monumental character by the simplest of means, viz., their arrangement as a recess or niche, which rises the whole height of the building, vaulted with pointed semi-domes, and enriched with stalactite vaulting, and painted in brilliant colours. In Egypt the arch-opening is cusped, which leads to a sub-division of its vaults into various forms, in which semi-domes and barrel vaults (both slightly pointed to accentuate the apex) intersected; to these I shall refer later on. Within these niches or portals, the doorway, windows, and decorative features, which give the scale to the portal, are placed; and being thus protected from the rain they are decorated with inlaid marbles and low relief ornament in great profusion. One of the earliest instances of this type of portal I am acquainted with in Mahometan work is that of the mosque of Tabreez in Persia, to which I have already alluded.

In India this feature acquires increased importance from the fact that the portal, with its supporting wings and crowning features, rises to a greater height than the main building itself, except the dome.

Fergusson, in speaking of this feature, observes, "The Gothic architects attempted something of this sort by making the outer openings of their doors considerably larger than the inner; in other words, by splaying widely the jambs of the portals. By this means, in some of the French cathedrals, the appearance of a very large portal is obtained with only the requisite and convenient size of opening; but in this they were far surpassed by the architects of the East, whose lofty and deeply-recessed portals, built on the same plan as at Tabreez, are unrivalled for grandeur and magnificence."

Fergusson also instances the portal of the Palace at Mashita in Mesopotamia as suggesting the feature; but we may go even farther back than that. The great portal of Tah Kesra, at Ctesiphon, A.D. 550, is much more characteristic of the type than Mashita, though the recess is much deeper here; and the arch of Firouzabad is the natural consequence of the arch of the Palace of Al Hadhr, which is based on the triumphal arches of the Romans. The great portal at Futteypore Sikri, already referred to, is semicircular in plan behind the thickness of the front wall; in its rear it is divided into three levels, archways or entrance doors below, clearstory windows above, and what corresponds to a triforium,—a small arcade running between, which gives scale to the features above and below and consequently to the great portal enclosing them all, the whole being covered by a semi-dome with stalactite pendentives,—the four-centred arch is more accentuated than usual and it is surrounded with the same rectangular frames that we find in all Saracenic buildings. So far it resembles the mosque at Sultanieh, but the great porch at Futteypore Sikri is crowned by a gallery of thirteen arcades equal in size, probably, to the arches of an ordinary mosque, each bay being vaulted and crowned with a small dome; furthermore, the angles of this block are enriched by octagonal shafts rising above the arcaded gallery and terminating with a finial. On either side, set back the thickness of the wall at an angle of 45°, are two wings of less height than the centre portal, in which we

* By Mr. R. Phené Spiers, F.S.A., being a paper read before the Architectural Association on the 3rd inst. Continued from p. 106.

find, again, the three levels, small entrance portals or windows, a pointed arch niche above with triforium arcades between, again giving scale to the larger features. These side wings are crowned with the Saracenic cresting, equivalent to our battlements, and the skyline is further broken and scale given by a series of domes carried on octagonal lanterns on the roof. It is difficult, of course, to describe such a building adequately, but it contains the first principle which should be observed in all monumental design, and with which architects of all periods have constantly been struggling, first to obtain grandeur by the introduction of large features; secondly, to give scale to these features by subordinate ones. The interior of the Church of Sta. Sophia, at Constantinople, the west fronts of many of the French cathedrals, and the west front of Peterborough Cathedral owe their magnificence, as it seems to me, to a due observance of this great principle.

2. *The Minaret.*

The minaret or tower from which the *muezzin* or call to prayer, is chanted dates from the twelfth century. The earliest type, called a Mabkhareh, is found in the mosque of Touloun. The lowest portion only may have been erected for defence, though Murray states that the upper floor was used for burning incense during the hour of prayer, which escaped through numerous apertures in the walls.

The minaret proper has one or more balconies from which the *muezzin* is chanted. In Egypt the lower portion of the tower is square till it reaches the parapet of the wall of the mosque; it is then changed to an octagon, sometimes with a plain cant, sometimes with mouldings set back, and sometimes with a broach. The first octagon story has openings in each side with projecting balconies in front. The balcony of the second story is corbelled out in stalactite vaults and stone balustrades, and the second floor is set back to give further space to the balcony. The balcony of the third story and the setting back is similar, and the crowning feature is of a bulb-like form. In two or three cases the feature is doubled, and in one case are four minaret turrets and bulb finials. The decoration of these three stories is of the most varied and beautiful description, horizontal bands of different coloured stones on diverse interlaced patterns reminding one somewhat of the brick Elizabethan chimneys. The balustrades of the earlier and better minarets consist of vertical posts of stone with marble slabs pierced, a direct descendant of the balustrades adopted in Byzantine architecture.

In Syria and Palestine the minarets, as a rule, have one balcony only at the top, which is sometimes covered over with a pent-roof.

In Spain the well-known example of the Giralda at Seville is a square tower, with its surface divided up and the panels enriched with Moresque ornament. The upper part of this tower is of Renaissance date, but probably represents the original form of the crowning feature, viz., two towers or turrets, each set back to allow of the upper balconies.

In India, curiously enough, the minaret does not form so essential a portion of the earlier mosques as in other Mahometan countries, although examples of a similar kind, built as towers of Victory, are to be found in the Minar at Ghasni, A.D. 977, and the Kutub, at Delhi, A.D. 1220. Isolated minarets are to be found here and there, attached to small mosques, but in the great mosques they are either attached to and form part of the central gateway, or are grouped as pendants to the domes. In the Taje Mehal, however, they form distinct features, and are placed at each angle of the terrace of the great tomb.

These minarets taper slightly from bottom to top, and are divided by overhanging balconies, and crowned with an octagon lantern, covered with a cupola. They owe their beauty probably more to their material, white marble, and to their surroundings than to their design.

In the Great Mosque at Delhi these minarets approach more to the forms of those in Constantinople, the least satisfactory form with which I am acquainted.

3. *Loggia.*

The loggia, which forms a pendant to the minaret (though it is found elsewhere) is simply a reproduction of arcades similar to those inside a mosque, viz., two or three arches carried on columns, a balcony between, and a projecting hood to keep the sun off. This loggia, raised on a plain ground story, is the chief monumental feature in the interior courts of houses and in other similar buildings, as, for instance, the court-house at Cairo.

4. *Domes.*

The dome is the one characteristic feature *par excellence* which the Mahometans seem to have made their own, though derived in the first instance from Byzantine domes. As I have before observed, it is not part of a mosque, but of a tomb, exception being made in favour of the mosques of Constantinople, all based on Sta. Sophia.

The earliest example existing is probably the tomb of Zobeide in Persia; there was one at Tabreez, but it is gone. The tomb of Sultanieh, in the beginning of the thirteenth century, is an early example, and there it is of a simple pointed form, with its springing on the level of the main cornice. In Egypt the earliest dome is that of Sultan Hassan, the springing-line of which is also on the same level as its octagonal base. In later examples it is raised on a vertical drum, which is described by Mr. Poole in his work on Egypt. The raising of the upper portion to a point is evidently done from constructional reasons. The beds of stone are horizontal to a certain distance, the upper portions only, I believe, having their joints at right angles to the external surface. Whether, as in the gate of the Jumna Musjid, there are layers in which the beds are part horizontal and part running to the central arch I have been unable to ascertain.

The stone domes of Cairo and Syria are decorated in various ways with beautiful flowing arabesque ornament, and probably carved *in situ*. The domes in brick are covered with stucco and adorned with ribs in vertical planes, sometimes, however, at the base interlacing with one another. The cylindrical drum on which the dome rests is pierced with windows, the whole being placed on a square tower with the corner angles canted off to form an octagonal base for the dome. In the interior these corners are supported by the pendentives, which, with their stalactite design, will be referred to later on.

In modern Cairene domes the bulbous form is adopted.

In Spain the dome is of small size, and invariably covered with tiles, sometimes glazed, and of various colours.

In Persia the Mosque of Teheran shows a marked acceptance of the bulbous dome which in India seems to be the result of a constructional requirement, viz., the counterpoise weight to the thrust of the upper portion. The subject is one which would be too long to enter into here. Dividing a pointed dome into seven heights, and assuming equal thickness, the relative weight will be 10, 10, 10, 9, 5, 3, 1. The lowest four sections could easily be constructed with horizontal beds. If, therefore, the upper portion be diminished in thickness, and the lower sections increased in weight by adding the bulbous form to the outside, the counterpoise might be so increased as to be able to resist the thrust of the upper portion. However, this is only a surmise on my part, which may have given origin to a form pleasing to the eyes of these people, who delighted in the bulbous form. The most remarkable construction produced in Indian examples are those of the Mosque of the Jumna Musjid and the Mosque of Mahomet at Beejapore. Fergusson in his work on Eastern Architecture, and in various papers he has read at the Institute, has entered so fully into their construction that I need not enter into it here, except to remark that his theory as to the resultants of the thrust of the diagonal arches being carried into the walls of the Tomb of Mahomet, are not realised in the earlier example, the Jumna Musjid, where the comparatively slight resistance to thrust that could be given by the small piers and adjoining arches suggests that there would be great excess of strength in the Tomb of Mahomet; except that the difference in diameter of the two might require it, in the latter 51 as against 97, the diameter of the rings of the dome. Instead of throwing the arches to carry the pendentives at 45° across the angles, the ribs are taken across to the second pier, and thus intersect one another, forming an extremely ingenious form of construction, of the principles of which Mr. Emerson availed himself in his design for the Liverpool Cathedral.

In Constantinople the form of the dome was based on that of Sta. Sophia, and as far as the development of that feature (the dome) is concerned, it is a matter of regret that the Turks obtained possession of Constantinople at too late a period in civilisation to develope it. Even the Mosque of Mehemet Ali, 1830-85, at Cairo, based on Sta. Sophia (though so badly built that it is already showing signs of ruin), in general internal effect of the dome is so fine that we regret that the feature was not more often adopted.

I have already pointed out the claims which Mahometan architecture has to be considered as a style resulting,—from the precepts laid down in the Koran,—from the requirements of the religion as regards plan of the general design of the architecture and the special form given to its features, whether constructed by Copts, Christians, Armenians, or the Indian people. I have now only to point out the same similarity in their details whether found in the far east of India or the west of Spain.

The details I mean divide themselves into two divisions:—1st, those arising out of constructive necessities first, though subsequently made decorative; 2nd, those which are simply decorative. The latter are so amply treated in Coste Bourgoin, Girard de Prangey, Prisse d'Avennes, and other authors, that I intend to pass them by and confine myself to the first class,—1st, the capitals of the columns; 2nd, the arch, round, pointed, horse-shoe, cusped, and trabeated; and, 3rd, the stalactite vault.

The Romans seem to have left such an enormous number of capitals, which the Mahometans adapted to their own buildings, that even as late as Sultan Moyed we find examples being still used up. In the Mosque of Ibn Touloun, however, we find an original treatment applied there,—it is true, to engaged columns only. The capital changes from round to square forms, and is covered with Saracenic ornament. The true Mahometan capital is a development of the stalactite character, and is designed on the correct principle from a circular shaft to a square cap, the width of which is the same as the thickness of the wall it carries and wider than the diminution of the shaft,—a true Byzantine principle.

In India the column is a rare feature; its place being taken by piers, and there is no distinctive capital. There is, however, the engaged column, which is treated similarly to the examples above quoted at Ibn Touloun.

The arch is the feature the Mahometans delighted most in. We find it, therefore, of the most varied forms.

The earliest example,—if we may accept any of Amrou as being old, or copied from old, examples,—is circular-headed, with a slight return inwards, suggested of the horseshoe arch. My impression is, however, that it has a special object. The lower or vertical part of the arch, the pier on which it rests, is wider than the thickness of the arch in order to receive the cross arches, and the lower part of the arch is brought out to meet it. In later examples it is brought out on two sides of the piers, and takes the place of the abacus in Byzantine examples. Mr. Carpenter suggests that the re-entering curve of the horseshoe arch is a recognition of the Byzantine abacus, which, as we know, is probably derived from the entablature above the Roman capital. Some of the arches at Amrou have the upper portion brought to a point by a straight line tangent to the curve, about two-thirds up: this has certainly a constructional reason to prevent the upper voussoirs from slipping down. The resistance to thrust of these arches at Amrou is obtained by wooden beams inserted above the capital, and henceforth these form an essential feature in all Cairene mosques. The arches at Ibn Touloun are the first genuine Mahometan arches. They are pointed arches, with the springing raised above the capital, and a slight return inwards suggesting the horseshoe arch. Later on in Cairene work we come to the trefoil arch; not, however, as an independent arch, but as part of a niche, and this is the favourite form throughout the fourteenth, fifteenth, and sixteenth centuries.

In Spain we have the typical horseshoe arch, with and without cusps, in the Mosque of Cordova, with a singular arrangement there apparently to eke out the height (the columns and capitals having been taken from earlier buildings) of a second tier of arches above the

lower arch, and in the richer portion of cusped arches thrown across. The arrangement of these arches in one sense takes the place of tracery, and I am astonished the feature has not been adapted in later times. It affords another example of that which is common to all styles, viz., the adoption of a construction expedient to decorative forms. The intersecting of these arches suggests a simple decoration, which forms the chief feature in the Alhambra. This, however, is only a conjecture on my part.

In India the arches are either simply pointed arches, as in Gaur, or pointed arches with the upper portion straight, as at Delhi, or a four-centred arch, the lower curve of small radius, the upper curve very large, or they are trefoil-cusped, or with a much larger number of cusps.

The cusped arch, however, is not introduced as a constructive, but as a decorative, feature.

The last form of arch, if I may so term it, is the straight arch, with voussoirs, of which so many examples are found in Cairo.

The decoration of the Mahometan arch is either confined to simple voussoirs, with a string or hood-mould round; to voussoirs of various-coloured stones, or painted to resemble them; or to surface decoration in plaster, as in Ibn Touloun; to surface carving, as in the architecture of India; or to glazed bricks or tiles, as in India and Persia. There is, however, a very important feature, the elaboration of which is pushed farther than in any other style, showing how the Mahometans delighted to play with constructive features; the chief reason for this being that they were forbidden by the Koran to copy nature in any form, whether animal or vegetable.

We are acquainted with the simple method by which in Romanesque work the voussoirs were prevented from slipping by a joggle or a rebated joint. The Saracenic architects, however, went much further than this, and the line of junction is composed of a series of curves so varied that it is to be wondered at how the voussoirs could be fitted together. There are many cases in Cairo in which it can now be seen that this intricate marble design is only a veneer, but there are others in which the thickness of the voussoirs is equal to the set-back of the arch, viz., from 4 in. to 6 in. How it was possible to put these voussoirs together, and to fit them one into another, puzzled me, until I saw an example in the possession of Sir Frederick Leighton, P.R.A., in which the face only is worked to the pattern, the back being cut away. In this case, I presume, the hollow spaces at the back, were afterwards grouted with liquid mortar.

I come now to the last section of my paper, that which deals with the feature known as the stalactite vault, a feature which characterises Mahometan architecture, and Mahometan architecture only, throughout the world.

I have long had a desire to study this subject and to endeavour, if possible, to trace its origin and development, and I only arrived at the theory which I am about to propound to you some three weeks ago. My first task was to read up the various authorities on the subject to see if they could give me any clue.

Prisse d'Avennes, in his "Arts Arabes," informs us that without doubt these vaults are built in imitation of the internal anatomy of some bulbous fruit (*pépin*), which may be the pomegranate, a theory about as probable as that which maintained that the vaults of Gothic churches were copied from groves of trees.

Kugler describes it "as a peculiar kind of architectural structure of which the striking effect may be attributed to its apparent constructive value and also to its organic (in the ideal sense) and fanciful character as a decoration. It occurs as a transition or interposed ornament supporting overhanging members of the edifice; for instance, as fitting up the internal angles where a cupola rises above a quadrangular space, and in various other instances it is used in certain places as a substitute for a complete arch and vault. It is an artificial system of projecting parts in which small brackets alternate with little niches with pointed arches, in such a way that the base of each superimposed bracket is over the centre of the niche below, and often so that the upper projection hangs over like a fir cone."

Schomoranz distinguishes three varieties,—Arab, Persian, and Mauresque,—each displaying certain peculiarities, resulting from character of materials, wood, alabaster, terra cotta, and stone.

Bourgoin speaks of them as "stalactites in projecting corbels, in vaults or pendentives, carved in stone and superimposed in courses, or else cut in wood and placed in juxtaposition in prisms, or worked in imitation of stone; they are constructional and ornamental, being features (motives) of form, their complete study should involve their setting out."

Ebers, in his work on Egypt, gives the following description, which is a literal translation from the German edition:—"Also the singular Arabic, peculiar to the style and of frequent occurrence, stalactite ornament which connects the vertical with the horizontal members of the building in such a charming manner, and the fantastic form of which as there found does not appear in any other style."

In the translation of Ebers's work into English (which is by a lady, by the way) I find the following delicious rendering of the phrase:—"We do not meet elsewhere with the peculiar Arabic and very frequent stalactitic ornament which is such a charming compromise and connecting link between the Flamboyant and the Perpendicular." Fergusson, in his "History of Eastern and Indian Architecture," gives a woodcut made from a sketch by him of a stalactite pendentive from the mosque at Old Delhi (which may date from 1220-30), where the angle is fitted up with a number of small imitations of arches bracketed out one beyond another; and he further adds, it was this form that was afterwards converted into the honeycomb work of the Arabs in Spain. He is no doubt referring here to the Alhambra, but as that palace was not commenced till 1272, and the internal decoration, including the stalactitic vault, was probably not erected till 1340. There are earlier instances to be met with in Egypt of a purer and more elementary form. Besides that, the way it is employed at Delhi is quite different from the principle of its formation in the pendentives of Egypt and Persia and Spain. In fact, it forms a parallel to the arch which I have described at Delhi. The Mahometan invaders insisted upon an arch as being part of the faith, and the Jaina builders erected one on their own trabeated principles, with straight joints, getting over the difficulty of the apex in the best way they could. So in this instance of the mosque at Delhi the pendentive is not curved on plan, but forms a corner bracket only, which is characteristic of Jaina architecture.

There are also other features of Jaina architecture (as Mr. Purdon Clarke has pointed out to me) which bear a singular resemblance to stalactite vaulting. The Jaina builders roofed their buildings with stone slabs; when, however, the bearing between the piers was too great to allow of their obtaining stone slabs sufficiently large, they reduced the bearing of the central span by carrying beams of stone across the angles in horizontal courses one above another, eventually reaching a span of sufficiently small size which could be covered by a single slab.

To lighten these slabs they cut out the soffit in semi-coffers, which when multiplied, on looking up at them, have certain resemblance to stalactite domes. I am convinced, however, that this is not the origin.

The result of my inquiry, which I venture to offer for your consideration, is this,—I have always been of opinion that stalactite ornament had originally a constructional origin, and I endeavoured to trace its development in Cairene structures, where they are, for the most part, worked in stone. I noticed that some of the portals were extremely simple in their forms, and that the sphere and barrel vault intersected by one another, and by plane surfaces, constituted the chief elements. Beginning, therefore, with these, I tried to sub-divide them, and introduce the varied forms which we see in the vault of the portal of the mosque tomb of Sultan Barkouk (fig. 2). I could not, however, evolve these out of the simple forms above mentioned. I came to the conclusion also that these elaborate stalactite vaults were really not constructive, but decorative, and that, therefore, they must originally have been copied from features in which the construction was effected in smaller materials. Now in Egypt, the pyramids and other buildings were too valuable a quarry, and too near to Cairo to warrant the employment of brick. I turned, therefore, to Persia, and, among other buildings, to the mosque of Tabreez, before referred to, where I found the stalactite vault built in brick and fully developed. One of the principal problems there solved was the transition from the square to a circular feature carrying a dome, and as this is done in each example by the feature known as a pendentive, I tried to work out the problem from that. It is evident that some centuries must have passed before the complete development of it at Tabreez and Sultanieh was carried out, and then there came this unfortunate dilemma with which I have already acquainted you, viz., that the history of the Mahometan styles in Persia for the first six centuries of the Hejira is a blank, with two exceptions to which I shall refer later on. The tradition of building, however, in the East is carried on from year to year, from century to century, so that on an examination of their later methods of building in brick, we may fairly assume it is not altogether different from that which existed in the eighth and ninth centuries. Now the most constant method of building the lower portion of pendentives in Persia and India (where brick and plaster are the sole materials) consists in the formation of a series of small arches one above another, and following the curve of the pendentives. Before, however, entering into this question, let me direct your attention for a moment to the pendentive, and the two principal forms it has taken in ancient times.

The pendentive at Sta. Sophia is a portion of a sphere whose radius is equal to half the diagonal of the square on which it rests.

That is, however, not the only method employed in the East, for in the architecture of the Sassanian dynasty, to which I have already referred, in the Palace of Serbistan, built 350 A.D., we find another method of getting from the square to the circular, viz., by throwing arches across; and here the pendentive is formed of six arches or orders superimposed.

Now, my theory is that if instead of having a series of concentric arches across the angles, all turned from the same springing, you turn these arches one above another and place them on the Byzantine pendentive, you arrive at the principle of the forms taken by the stalactite vault (and curiously enough in the Pantheon at Rome and the dome in the Palace of Diocletian at Spalato, we find this principle carried out in the building of the dome itself up to about two-thirds of the height of the curve, and a pendentive never exceeds that). Now, in the stalactite pendentives of Tabreez and Sultanieh the spaces enclosed within the arches are hollowed out in a series of niches, and it is just possible that the peculiar form of the dome of the tomb of Zobeide is owing to its construction of small arches and hollow niches. If so I find in this tomb, which may date from the eighth or ninth century, the proof of my theory. Unfortunately, there is no record of the construction of this tomb, and Mr. Pullan (who was associated with M. Texier) is unable to give me any information thereon. My drawing is taken from Fergusson, who copied it from Texier's unpublished drawings.

If this theory of mine be accepted, then I have to assume that, although the earliest forms of stalactite were built in this way in brick, subsequently when they were copied in stone it was found much easier to build the whole pendentive up solid in horizontal courses, and to cut the constructional forms as a decoration afterwards in the stone. A precisely similar evolution is found in fan-vaulting, which in its origin consisted of ribs of the same curve with web vaulting between each; subsequently it was erected solid, the ribs being carved out afterwards.

With this theory in my mind, I paid a visit to Mr. Purdon Clarke, at South Kensington, who has seen the modern Persian workmen construct their stalactite vaults in plaster, and he gave me a description of the way they set to work; the example was the decoration of a room with stalactite vaults at each angle and pendant in the centre. The plan was first made out on the floor, the outlines of the several levels being strongly marked out. Then thin slabs of stone were cut to the outline of each level and subsequently built in the wall at the required height. It should be noticed, therefore, that there would always be above the curved form of each course of stalactites, an upright vertical surface from 1½ in. to 2 in. deep; this is the template. When the bearing of the templates becomes too great, they are supported in the centre by

chains from beams fixed above the stalactite ceiling, and in the case of pendent stalactites similar chains are suspended to take them. These chains are afterwards coated with plaster to make them rigid like columns. The positions of all these templates and chains are carefully ascertained by plumbing from above down to the ground plan. The result will be a series of shelves or brackets, on which the plasterer commences his work, commencing at the bottom and moulding each stalactite niche resting on the lower template and working it up to the upper one. This description enabled me to understand how the work in Cairo was set out, for applying this principle to the formation of the stone stalactite vaults in Egypt, and assuming, as I have done, that the horizontal courses of stone were carved afterwards, it would be easy to work out the upper surface of each course by means of a template to the form set out on plan; and it will be observed (see figs. 1 and 2) that in every case here in the stone vault there is always the same upright or vertical band about 1½ in. to 2 in. deep to each course, to which I referred in speaking of the modern Persian plaster vaults. When once this was obtained it would be easy either in stone or plaster to work back to the plan of the course beneath, and much easier to leave a stone pendant than to form a plaster one. The pendentives in the bath of Mokoyet, Cairo, and the corbelled balconies of the Mosque of Imam-es-Shafeeh may be taken as evidences of the dexterity with which these features were carved out of the solid stone. I ascribe these features to the middle of the twelfth century, which is also an evidence of extraordinary preservation.

I should say that the earlier stalactites are much simpler and purer in form than those of later date. The miniature arches are always correct curves struck from a single centre, with a slight flattening of the apex. Whether there was any difficulty in getting the workmen to work to these curves, or whether they thought they might get what they considered to be a better form, I know not, but the later forms are not curved, but consist of a slope and a perpendicular surface. They look hard and unpleasing in comparison with the curved form, and of course naturally as the traditions of the earlier forms died out, we find these stalactites carved as a surface ornament, endeavouring by elaboration and multiplicity to make up for brilliant contrast of light and shade; the greatest decadence being observable in the Turkish stalactite, which has little to recommend it.

Now the pendentive of the tomb of the Sultan Barkouk is the simplest solution of the problem, though of much later date, but there is a want of variety and an absence of those deep points of shade which are so necessary in a country where reflected light is so powerful. The next solution I find in the pendentives of the baths of Mokoyet, in Cairo. Here in the upper row but one of arches, the curve of its projection on plan is not quite circular, but enters inwards towards the angle, and a series of five pendants, miniature copies of those in fan-vaulting, are formed. It is easy, however, here to see how this could be constructed in the same way, only involving additional labour in the cutting-out of the recess behind them. If, however, in this example you will suppose the beds of stone to have been carried back right to the corner, and to have been carried back farther and farther at each level in descending, until you came back to the corner of the angle, the result will be similar to the stalactite pendentives of the vestibule of Sultan Hassan (fig. 1), and of the portal of Barkouk (fig. 2).

Want of time has prevented my entering further into the application of stalactite vaulting, not only in pendentives and domes, and recesses, but in capitals (see fig. 3), corbels, cornices, and the corbelling out of balconies, &c., as also the diversified forms which it takes in wood, examples of which you will find in the various drawings, diagrams, and photographs I exhibit to-night. Taking some of the simpler forms, a former pupil of mine, who passed through Cairo, has sent me some diagrams of two or three vaults he examined carefully, but as he is going to publish them himself I shall limit myself to a few general remarks. The main forms of the curves in these examples are spheres and barrel-vaults, with horizontal or rising apices in order to accentuate the apex. (They are cut afterwards, I presume, to a point, and form entering angles instead of a simple curve.)

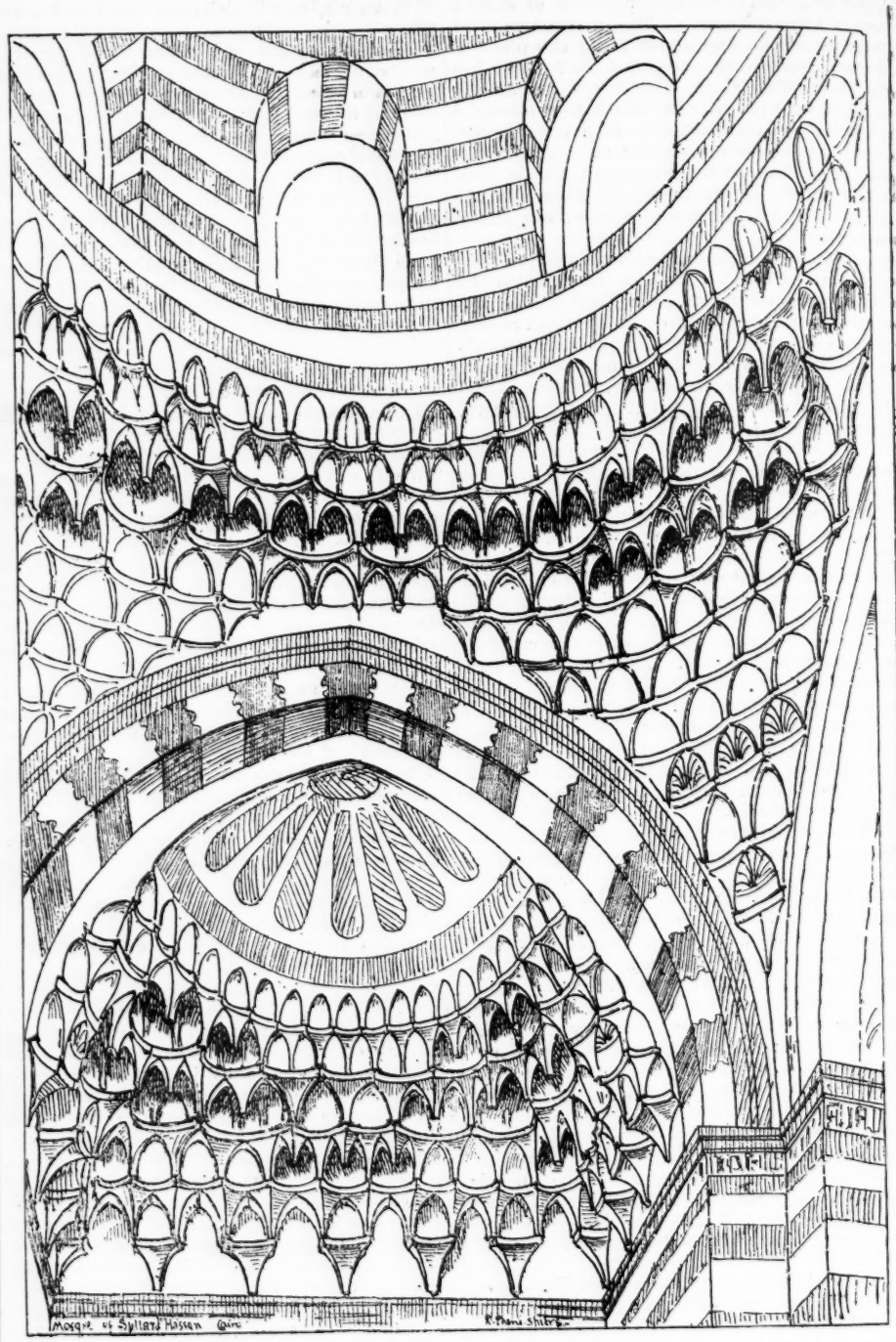


Fig. 1.—Vestibule of Mosque of Sultan Hassan, Cairo.

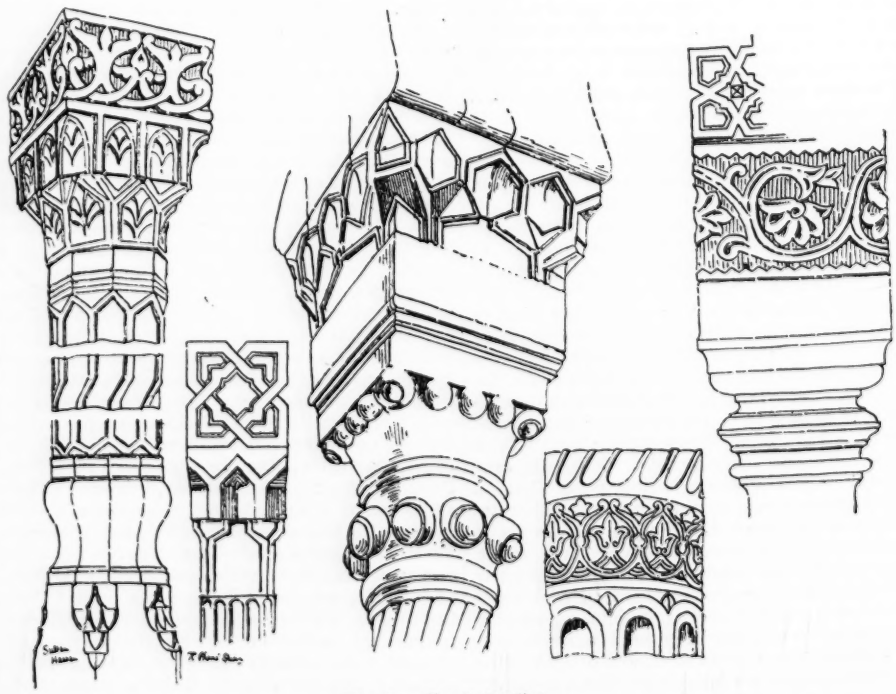


Fig. 3.—Capitals, Cairo.

Wells Cathedral from Bath Rd N.E.

Roland W. Paul 17 Sept. 87

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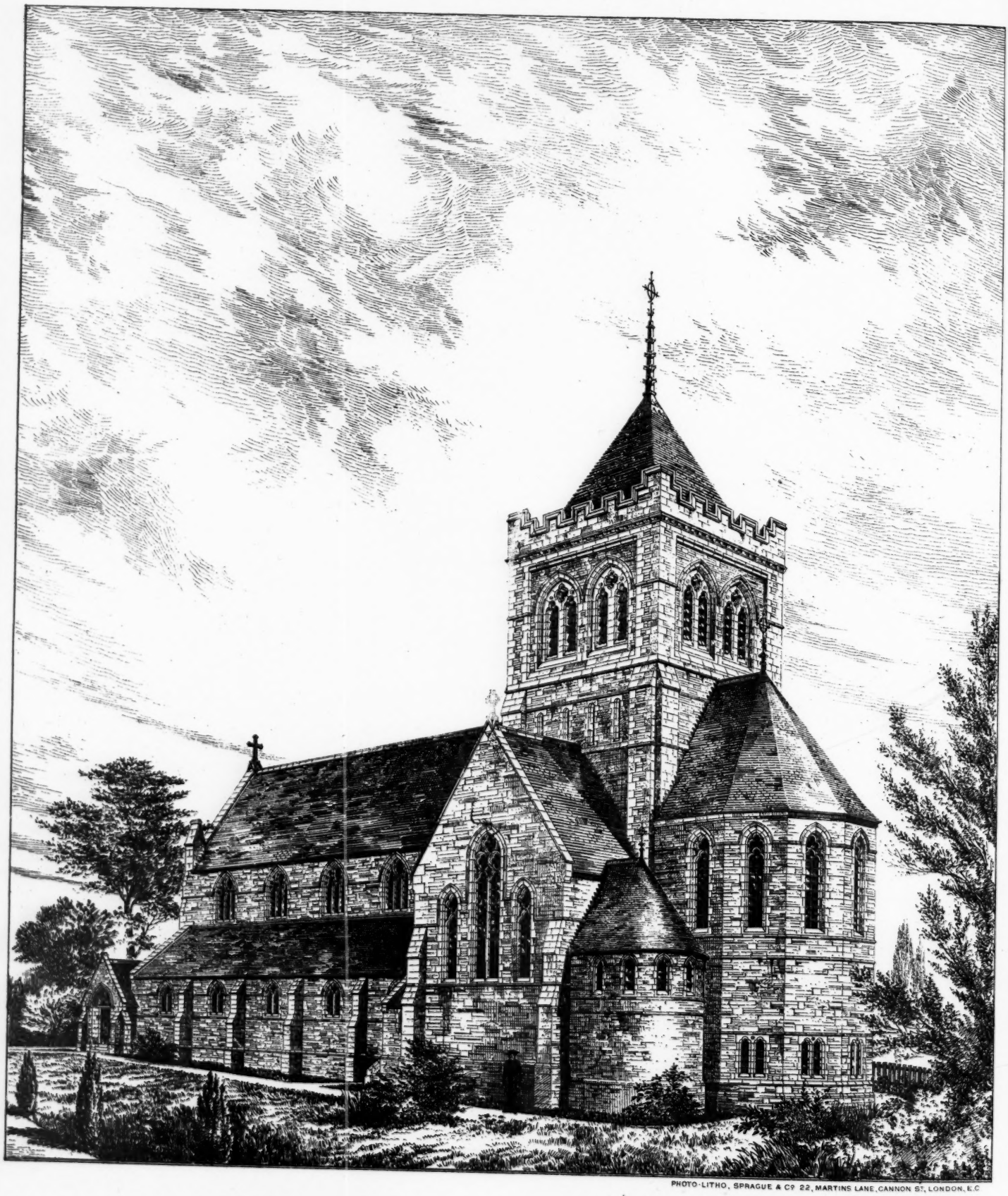

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ST. BARNABAS, GILLINGHAM, KENT.—Messrs. J. E. K. and J. P. Cutts, Architects.

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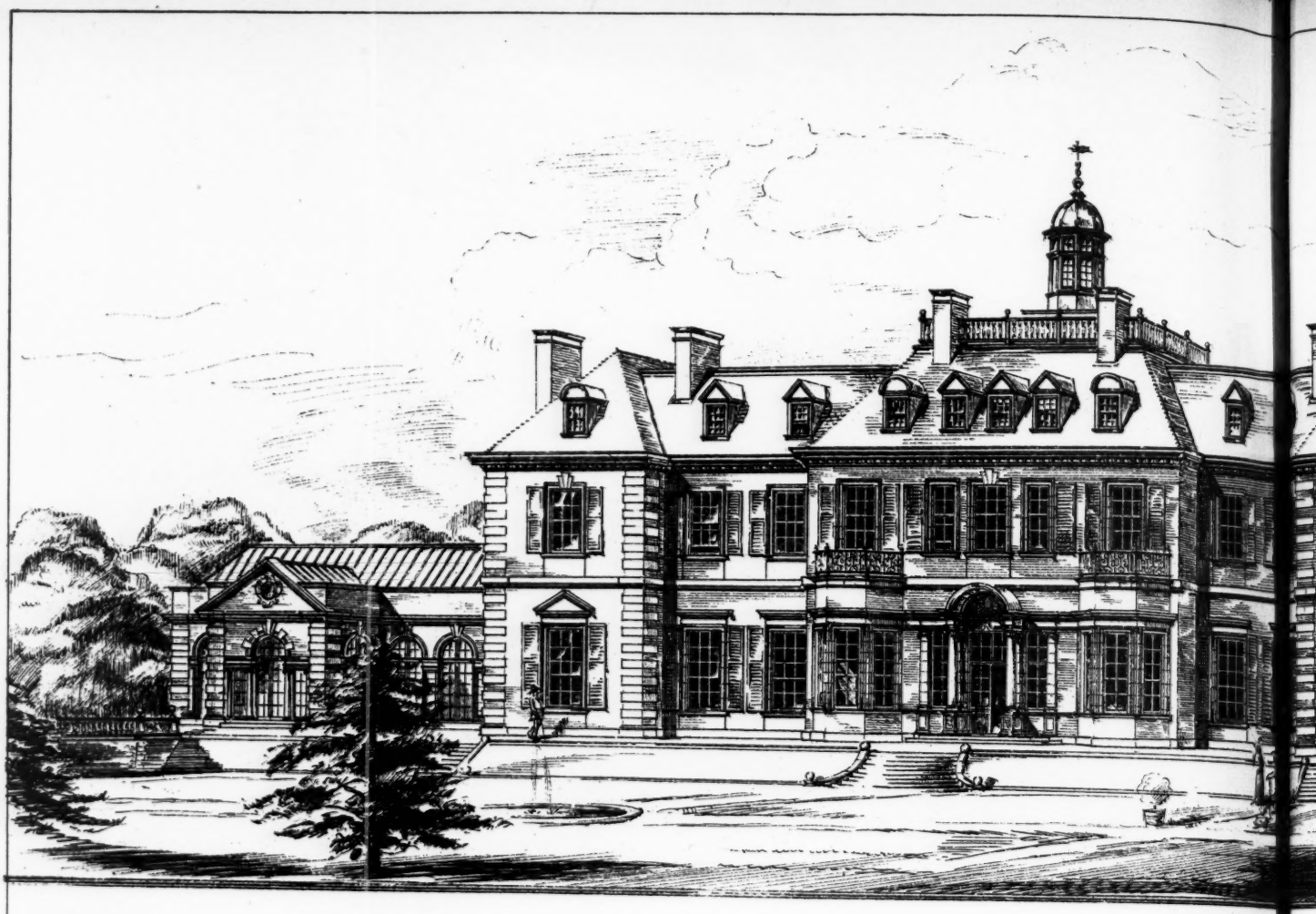

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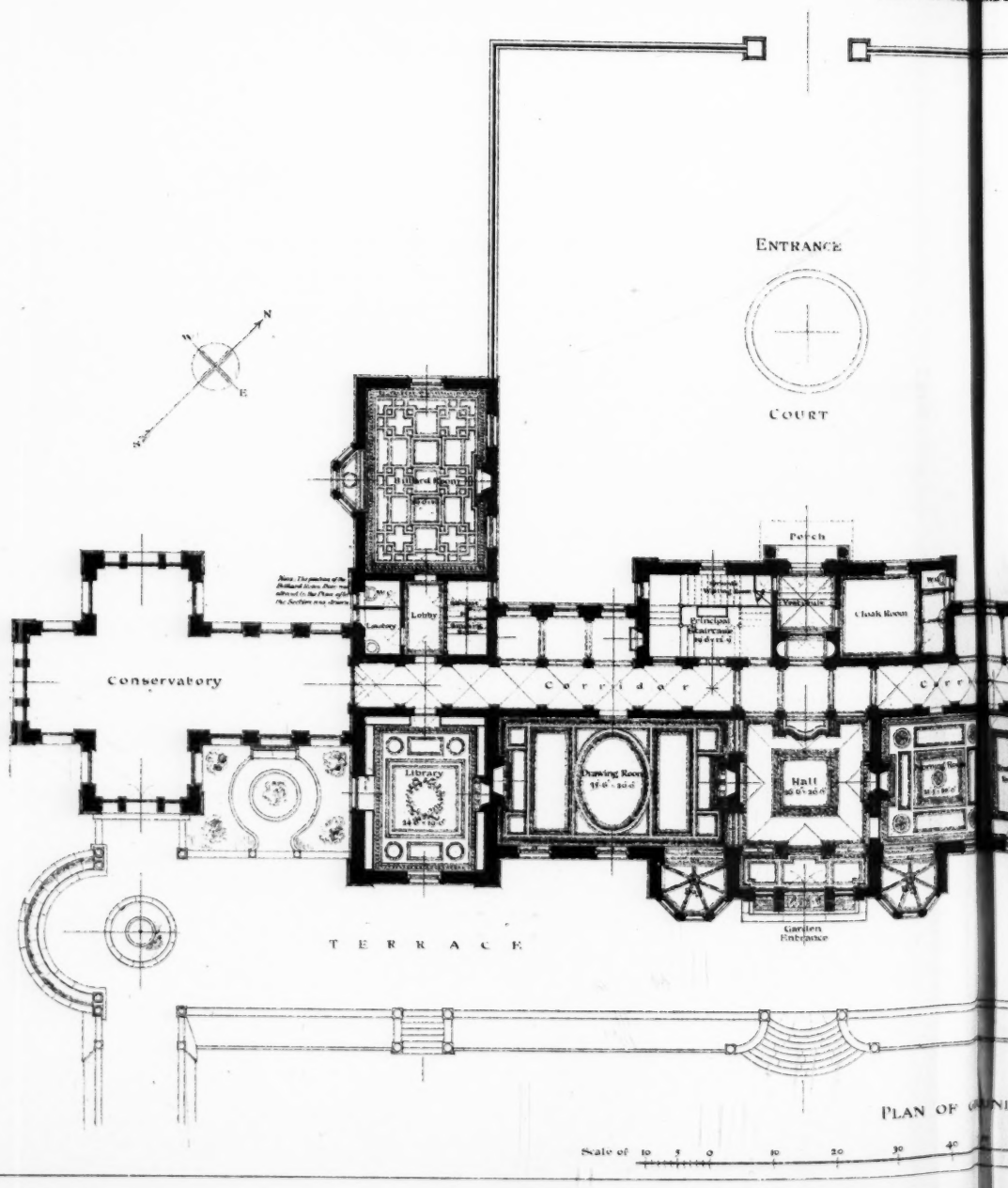
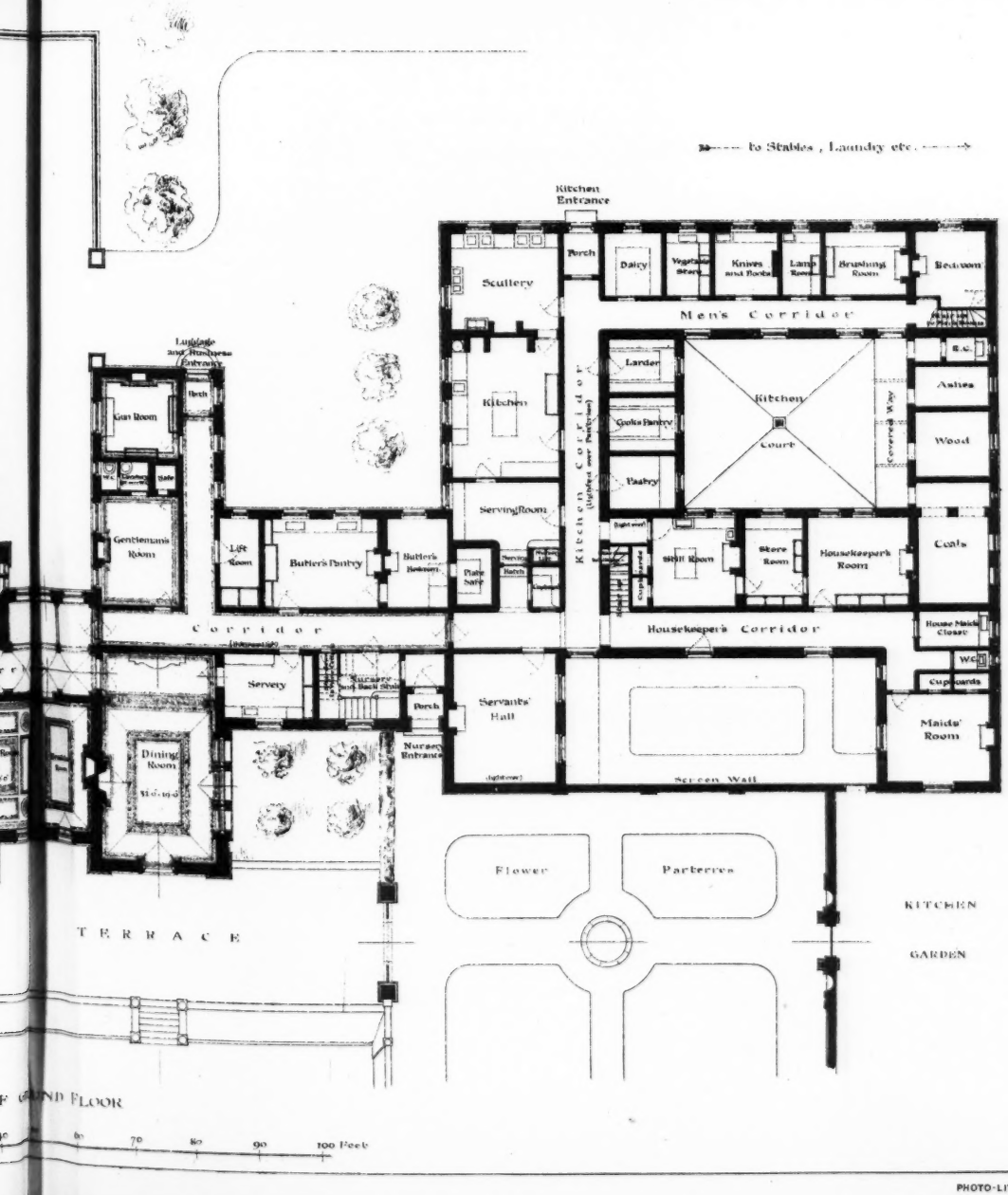


PLAN OF

Awarded a Certificate of Honour, Soane Medallion Competition, 1888.

A DESIGN FOR A COUNT

THE GARDEN FRONT.



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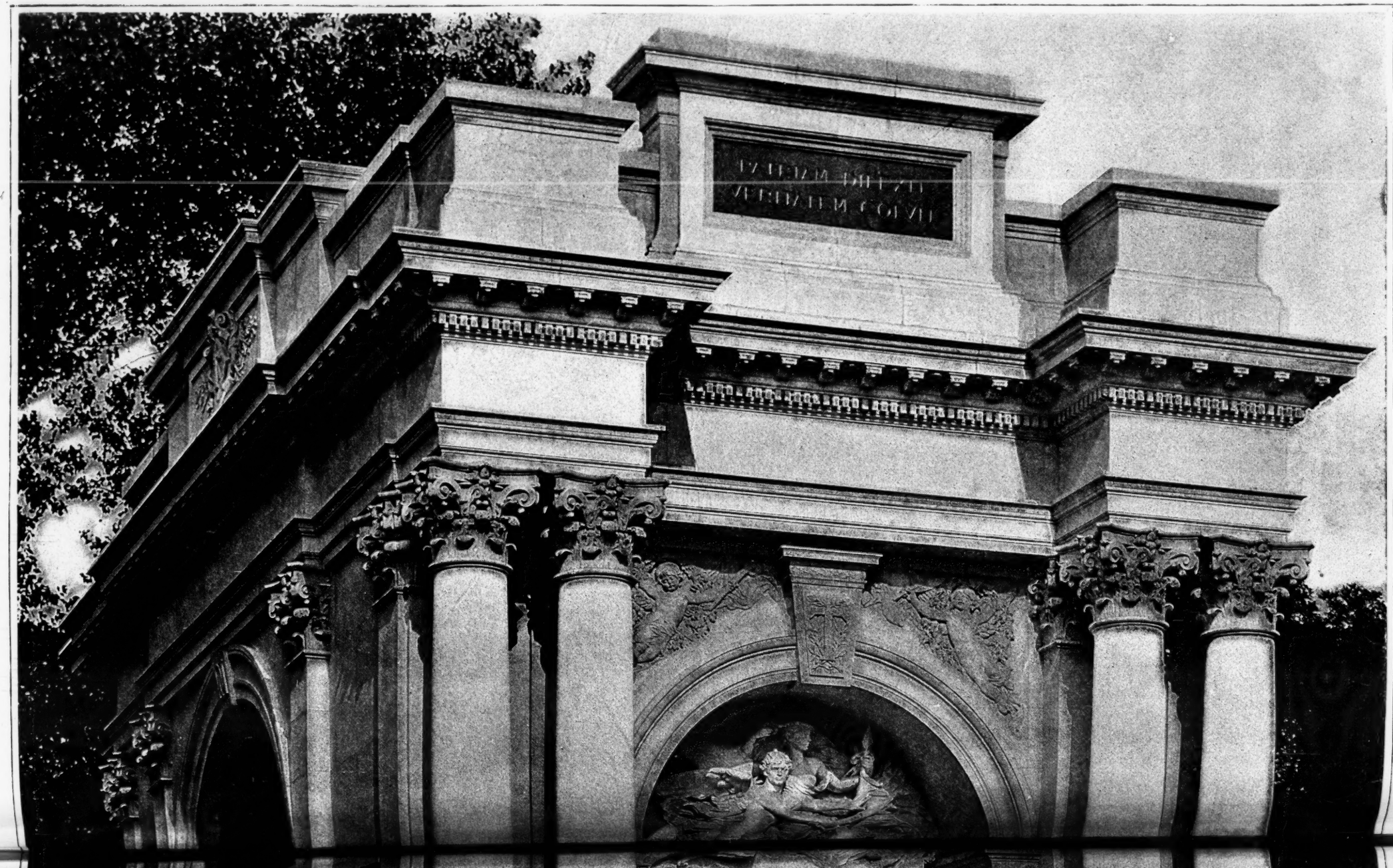
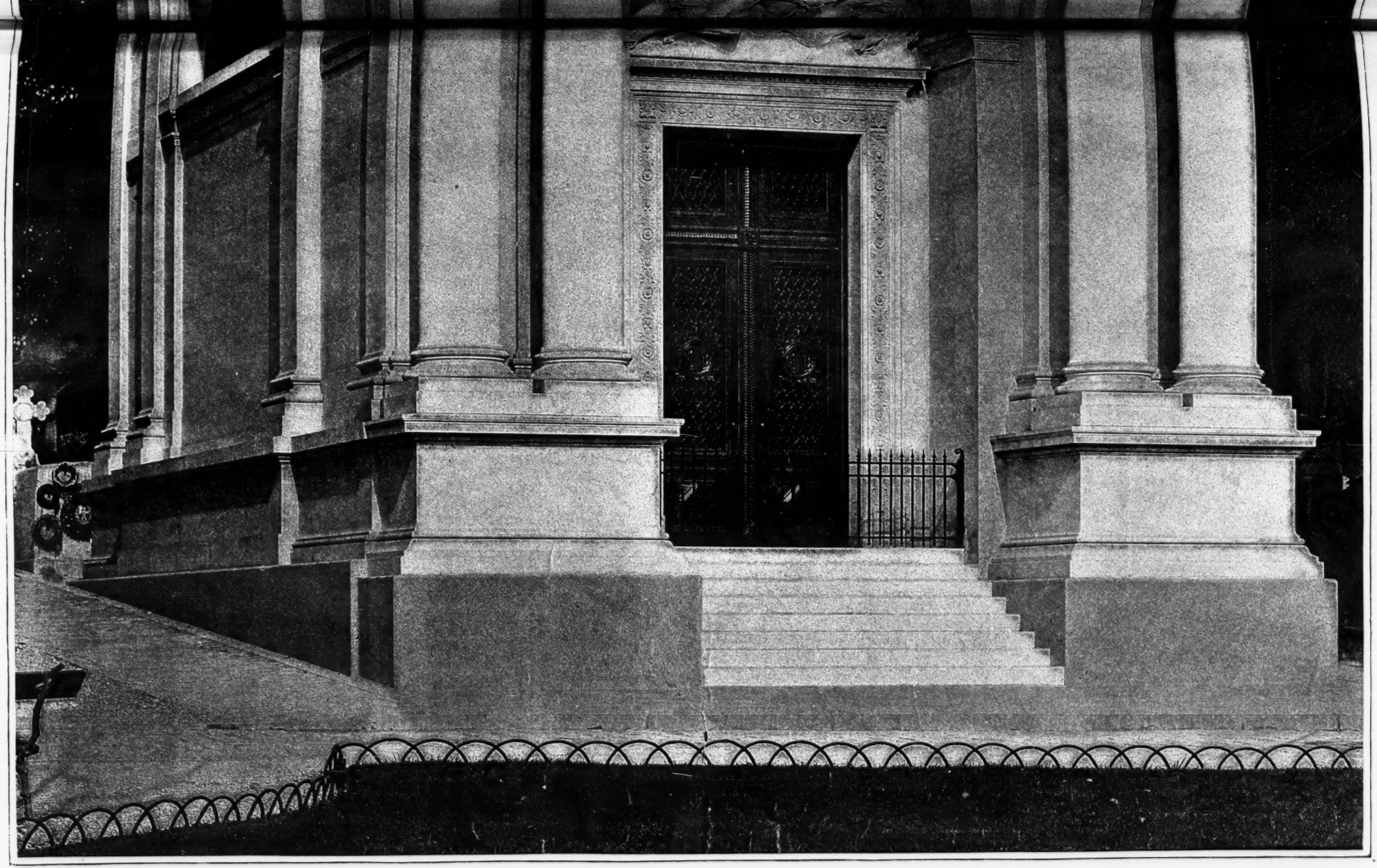
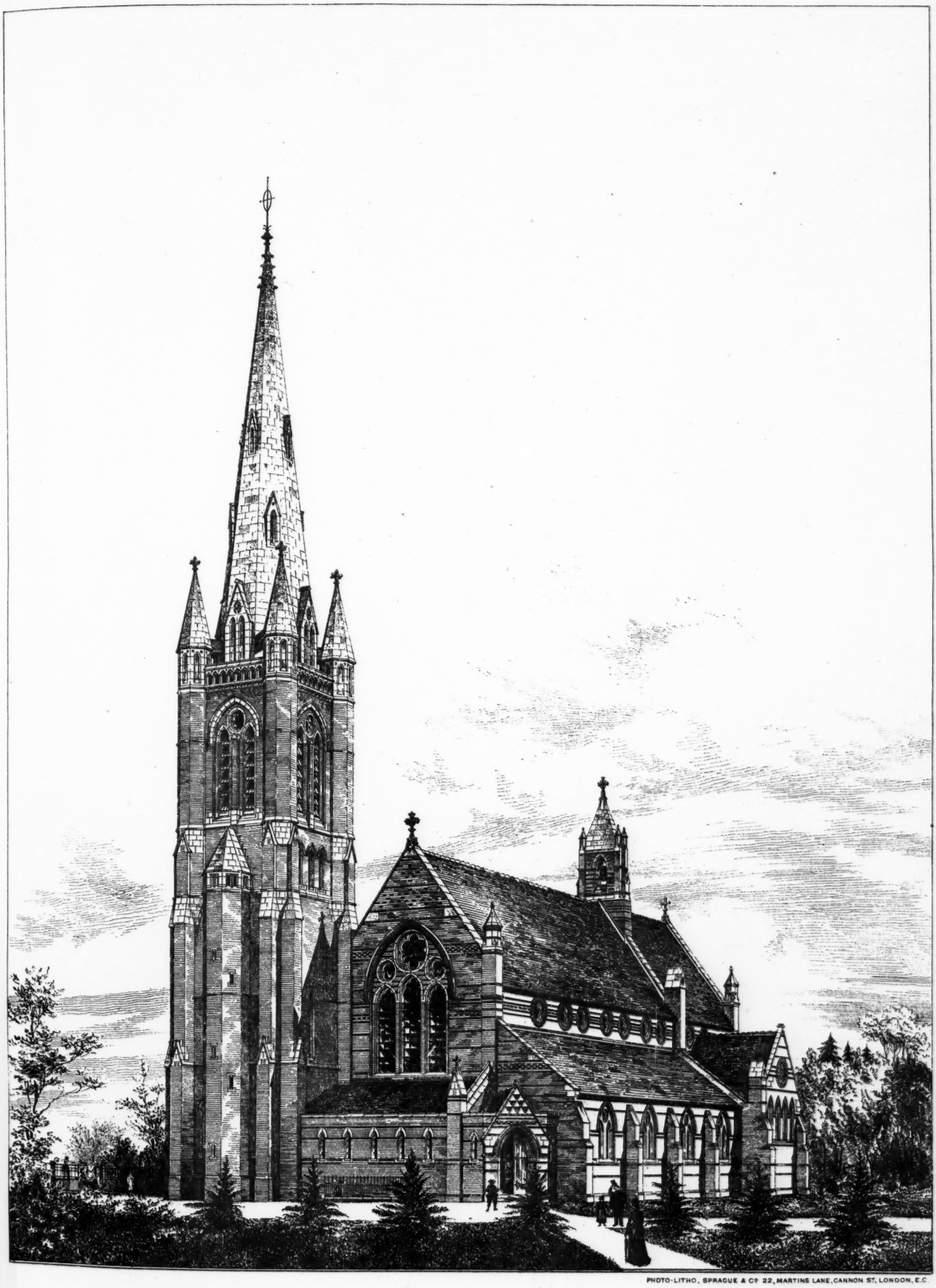
NT HOUSE.—By Mr. F. W. Troup.





The Phototype Co., 303, Strand, London.

THE THIERS MONUMENT, IN THE CEMETERY OF PÈRE LACHAISE, PARIS. M. ALDROPHE, ARCHITECT.



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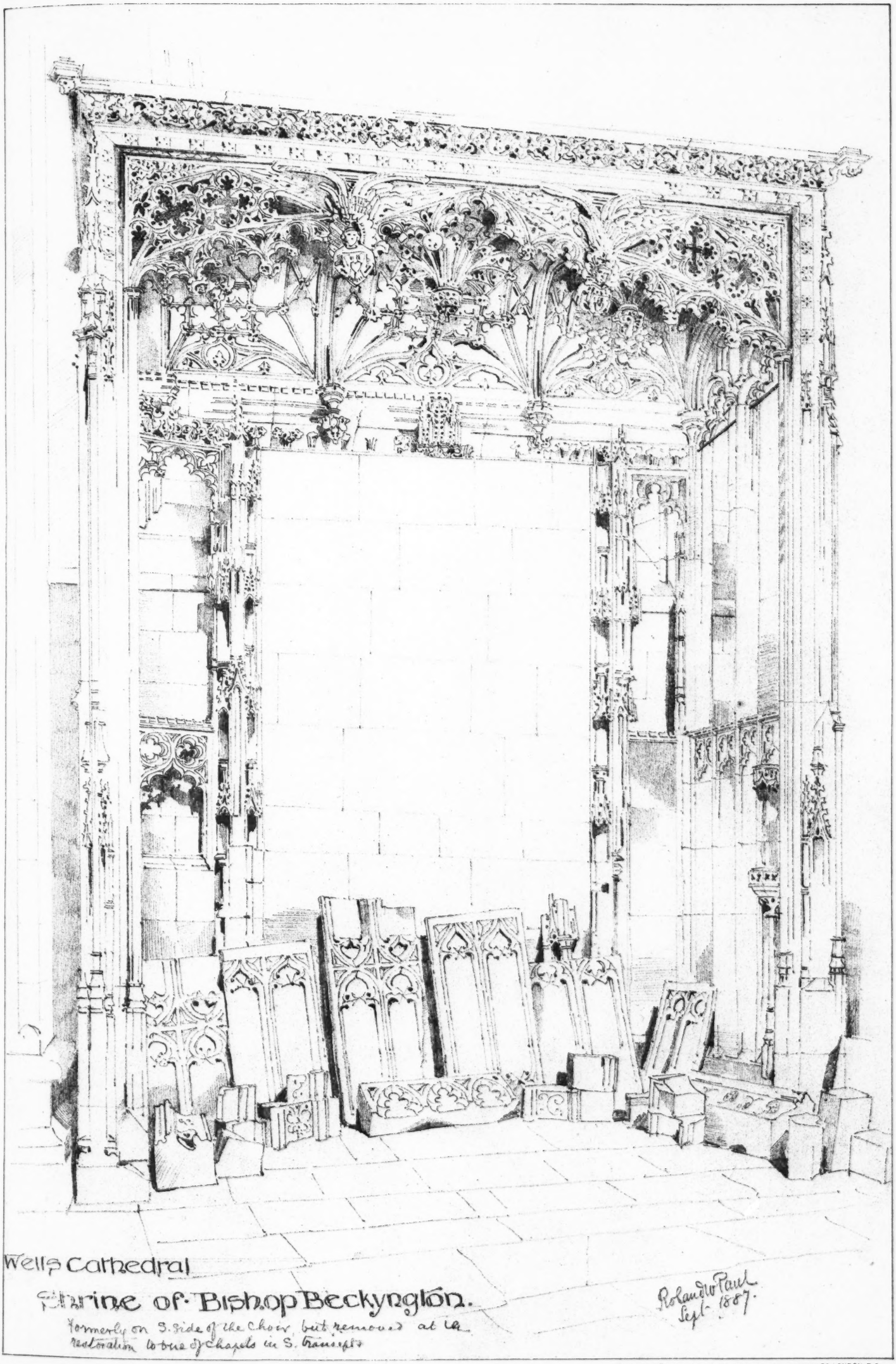
ST. MARK'S, FARNBOROUGH.—Messrs. J. E. K. and J. P. Cutts, Architects.


Wells Cathedral
Shrine of Bishop Beckyngton.
Formerly on S. side of the Choir but removed at the restoration to one of Chapels in S. Transept
Roland W. Paul
Sept. 1887.

"INK-PHOTO," SPRAGUE & Co., 22, MARTINS LANE, CANNON ST., LONDON, E.C.

Awarded Pugin Travelling Studentship, 1888.

An account of the stalactite vault would be incomplete if I did not refer to those of the Alhambra, which Owen Jones, at all events, succeeded in reproducing at the Crystal Palace, though I am bound to say their formation is still as yet unintelligible to me. He gives a series of diagrams of the various prisms, which, being applied in a certain sequence, constitute the surface of the stalactite vault in the Alhambra; he omits, however, to describe how the main structure is arrived at on which he places these stalactite dies, and, as in the Hall of the Aberranges, there is the most complicated arrangement I am acquainted with, something more is required before I shall be able to understand how he carried out the work in the Crystal Palace.

My conclusion shall be a short one. I have endeavoured to point out that the style which I have selected for my paper this evening is one which merits your attention, first, because it is based on the arrangement of plan required by the religion; secondly, that its main features have followed a natural development founded on its needs first, and secondly on the natural desire for monumental display; thirdly, that its decorative details throughout the world are more or less similar, which is an evidence of their having been curtailed or amplified by the precepts of the Koran; and, fourthly, that whilst its earlier forms were based on constructive problems, at subsequent periods the constructive features thus evolved have been adopted as decorative ones; in this application they have followed the example of all other true styles. I might, if time had permitted, have called the especial attention of students to one very important lesson, viz., that in Cairo at least the mosques and other buildings are designed to suit the positions they occupy, and I am unable to agree with Franz Bey in his *résumé* of the Saracenic style in that town, quoted in Mr. Poole's work, that the want of symmetry of plan which he alludes to is an imperfection. The plans *are* symmetrical where advisable, but they do not hesitate to place their features where they are required, the result being that their domes and minarets form a more picturesque assemblage than the same features in Persia and India, and are in strict accord with the street architecture, of which they form so essential a part.

Mr. James W. Wild (Curator of the Soane Museum) in opening the discussion referred to the difficulty of dealing with the construction of stalactite vaulting. He knew that Owen Jones had it built up in prisms, the angle being made and the prisms stuck round the wall. In wooden architecture this stalactite ornament was a most puzzling thing. He had one example in his possession, consisting entirely of a series of wooden prisms nailed into one another, and with the edges curved. Mr. Spiers had referred to the columns taken in Egypt and Damascus, and he might add that those found in the mosques of Cairo were nearly all of the same size, whatever might be the height and width of the arches they supported, deficiency in height being made good by adding to the abacus above the capital, and by stilting the plinth under the base. These columns are of veined white marble, and of a debased kind of Corinthian order. He (Mr. Wild) thought they might have come from the ruins of Alexandria, where even now remains of the ancient city are found, in the now deserted space around it. But afterwards at Seville he found in several courts of houses built about 100 years ago columns of much the same kind, but with capitals of a Gothic character, which he should have taken to be of the thirteenth or fourteenth century. The Consul, however, informed him that they came from Carrara into the yards in quantities, and were used up as required, and that the same model always was followed. This appeared to throw some light upon the columns at Cairo, which, as was well known, had always a large commerce with Italy. No marble is found in Egypt, but great quantities of Italian marble have for centuries been used there for pavements, lining of walls, &c., chiefly of the kind which comes from near Carrara. So that it appears probable that these columns in the mosques of Cairo were shipped ready made to Egypt from Leghorn.

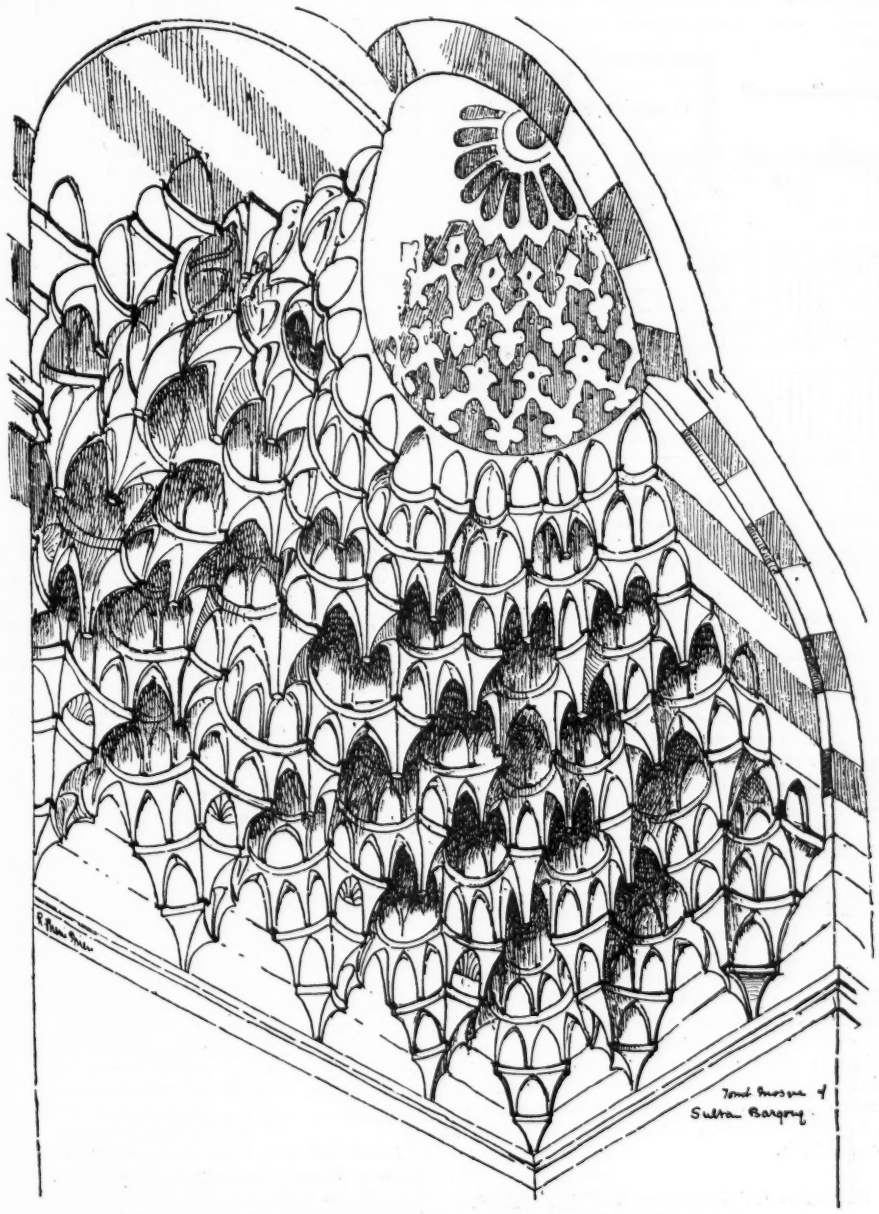


Fig. 2.—Portal of Mosque Tomb of Sultan Barkouk, Cairo.

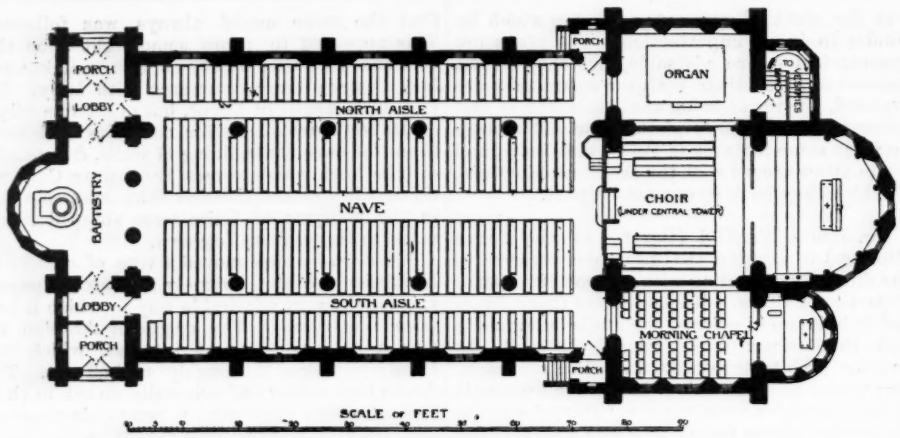
Mr. J. P. Seddon moved a vote of thanks to Mr. Spiers for his extremely interesting paper, and for the very admirable way in which it had been illustrated. The origin of Arabian art was a subject of great interest, which had hardly yet been thoroughly worked out. The Arabs themselves had originally no art in their own country; they were a conquering nation, and could not have brought it with them. Where, then, did it come from? They must take it that when the Arabs did settle down, like most of the nations who helped to destroy Rome, they utilised the materials on the spot, using the old columns to a great extent. The Greeks were really the only nation who had put into architectural form the crude decorative notions, which were previously undisciplined, and very largely distributed all over the East. No doubt they had also great connexion with India, and knew of the interesting works of architecture with many elements of a decorative character in them. Their new masters opened up a different problem to what the Romans had done, who merely wanted their own grand structures covered with a semblance of Greek art. The Arabs put new problems to them; they were well-educated and elegant-minded men, who luxuriated in a lovely description of work, and the Byzantines, who really were the Greeks of that date, no doubt worked out the theory and put into practice the requirements put to them by the Arabs. So that they would find in the Byzantine, and not in the infusion of mere Indian work, the elements of Arab art, which, after all, could never become an architectural style. It was very lovely, ingenious, and full of interest, but it was too Oriental in character, and possessed too little of the dignity and element of proportion ever to become a style of architecture. In the case of the Alhambra, they saw it almost in its decadence, for there were to be found extremely lovely details, singularly wanting in all the features that a style of architecture gave. Therefore, although it was a grand quarry for the architect, who could learn a great deal by studying it, there was nothing seriously to be gained from it in an architectural sense. At the same time it was most charming, and interesting, especially on account of its adaptation of colour.

Mr. H. D. Appleton seconded the vote of thanks.

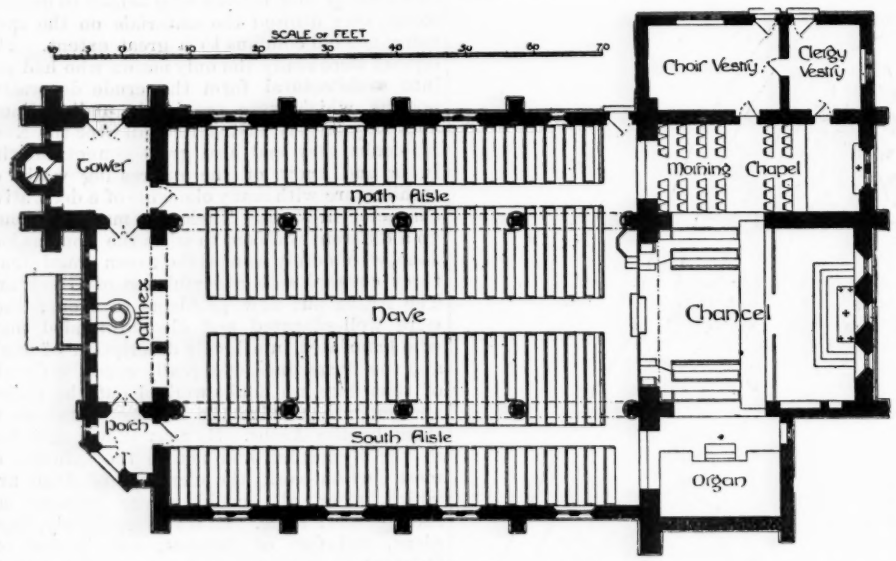
The Chairman (Mr. John Slater, President) said it would have been pleasant to have had a much longer discussion on Mr. Spiers's interesting and exhaustive paper, but as the hour was late, it could not be prolonged. The principal matter in the paper, viz., the working out of the stalactite evolution, was an extremely complicated subject, but as far as he had been able to follow Mr. Spiers, he certainly appeared to have shown how such a very intricate form was evolved from a much simpler and earlier form. As a matter of fact, that was the principle which underlay nearly every architectural form. Nothing ever sprang into existence without being developed from something quite different, and being gradually worked out of something very much simpler in its initiation.

The vote of thanks was then put, and carried by acclamation.

Mr. Spiers, in replying, said it was perhaps rather rash to have brought out a theory, as he had done, in the presence of Mr. Wild, who had drawn all the vaults in Cairo in former days. Mr. Wild in his early days had been one of the most diligent students of Egypt, and possessed drawings of all the stalactite vaults. He (the speaker) maintained that he had attempted to go further than DeVogüé had, and he considered they must go back to brick forms. What Mr. Wild had said with regard to capitals was very interesting. No doubt it was true that there had been a trade with Carrara, and that materials were got from that place. Mr. Seddon's remarks about the influence of the Greeks and Byzantines were correct. The latter derived



Plan of St. Barnabas, Gillingham.



Plan of St. Mark's, Farnborough.

their principles from the Greeks, and were responsible for a good deal of what was to be seen. It was well known that the influence of Greek workmanship in the East lasted through the first ten centuries of the Christian era. Mr. Spiers, in conclusion, said he desired to record his thanks to those who had so kindly lent drawings to illustrate his paper, notably Mr. Carpenter and Mr. Emerson.

Illustrations.

THE THIERS MONUMENT, PÈRE LA CHAISE, PARIS.

REFERENCE was made to this monument some time since in one of our "Letters from Paris." It is built on the highest ground of the Père la Chaise Cemetery, to the right of the Catholic Chapel. The height of the whole façade is a little over forty feet. The plinth is of granite, the remainder of the structure is of stone. The bas-relief over the entrance is by M. Chapu, sculptor, and the general design of the whole by M. Aldrophe, architect.

There are two other basreliefs in the interior also by M. Chapu; these are executed in marble; and at the back of the interior is an allegorical group by M. Mercié.

Some further description of the monument will be found in the *Builder* for October 1, 1887, "Letter from Paris," page 454.

DESIGN FOR A COUNTRY HOUSE.

WE give the plan and perspective view of this design, which gained an "Honourable Mention" in the recent competition for the Soane Medallion. The author is Mr. F. W. Troup.

CHURCH OF ST. BARNABAS, GILLINGHAM, KENT.

THIS church is to be erected to meet the wants of this growing suburb of Chatham. It will be built of brick faced with Kentish rag externally, and plastered internally, and finished with Bath stone dressings throughout. The roofs will be covered with tiles. The accommodation is for 710 persons, and the building is estimated to cost, complete, about 8,000*l*. The church will stand on sloping ground, and the vestries are therefore placed under the east end.

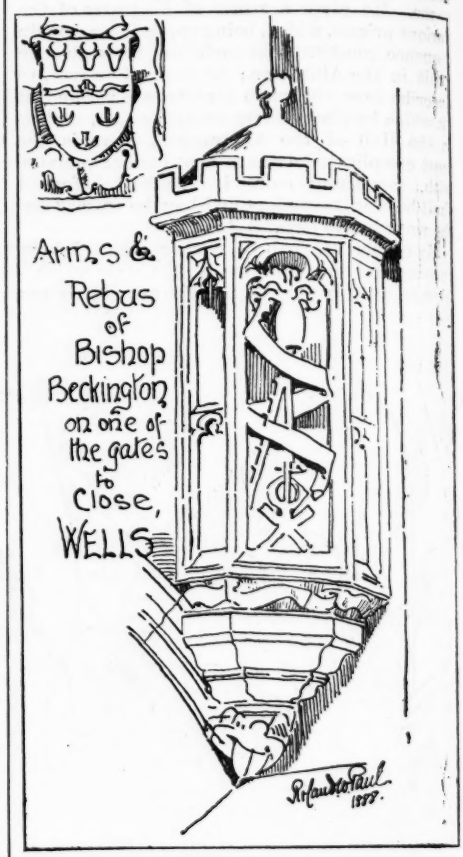
CHURCH OF ST. MARK, FARNBOROUGH, HANTS.

THE foundation-stone of this church was laid in July, 1880, by H.R.H. the Duchess of Connaught, and the nave and chancel were opened for use in September, 1881. The organ-chamber has just been built, and it is now intended to proceed with the completion of the church. A tower has been added to the design in the hope that it may eventually be built. The complete church will seat 620 persons at a cost (inclusive of temporary work, but exclusive of tower and spire) of about 5,000*l*.

SHRINE OF BISHOP BECKINGTON, WELLS CATHEDRAL.

THOMAS BECKINGTON, or Beckyngton, Bishop of Bath and Wells, was one of the most important prelates who occupied the see. Consecrated in October, 1443, he had previously been educated at Winchester and New College, Oxford, was appointed Chancellor of Oxford, 1442, a Canon of York, and afterwards of Wells. Probably his association with the great William of Wykeham gave him that taste for building which he exercised afterwards in his cathedral and city. He built the west walk of the cloisters and most of the Perpendicular work in the cathedral is of his time. The most notable additions were the three gateways,—two to the close and one to the Bishop's Palace,—all of which bear his rebus, a flaming beacon on a tun; of one of these a sketch is subjoined. This device is also to be seen at Lincoln College, Oxford, on his buildings there. The houses on the north side of the Market Place at Wells, now much altered, and the conduit which stood on the site, now occupied by a fountain, were also his works.

The shrine given is at present placed here against the wall in the Chapel of St. Calixtus in the south transept of the cathedral. It formerly stood against the column in the easternmost bay but one on the south side of the choir, together with the tomb of the bishop



The tomb still remains in the south aisle, but the beautiful canopy was barbarously removed from its position during the restoration of the choir, by Salvin, in 1848, and the ironwork which enclosed it forms part of the screen-work to the side chapels. Considering the importance of the memorial, and the importance of the man, it seems almost incredible that such an act of vandalism should have been allowed to occur, and it is to be hoped that, at no short distance of time, the shrine will be replaced in its ancient and proper position, thereby forming an additional beauty in the choir of the cathedral at Wells.

ROLAND W. PAUL.

WELLS CATHEDRAL FROM THE BATH ROAD.

THIS sketch of Wells, with the octagonal chapter-house prominent in the view, is one of the series of sketches by which its author, Mr. Roland W. Paul, gained the Pugin Travelling Studentship for this year at the Institute of Architects.

COMPETITIONS.

Board Schools, Tottenham.—The Tottenham School Board having decided to erect new schools for 1,500 children at Seven Sisters-road, invited twelve architects to submit designs. Mr. E. R. Robson, F.S.A., was appointed referee, and in his report stated that all the plans showed merit, and recommended that the designs marked "New Year" and "Bonâ-fide" should be placed first and second. These were found both to be by Mr. Charles Bell, F.R.I.B.A., Dashwood House, 9, New Broad-street, and the Board have accordingly appointed Mr. Bell architect for the new schools.

Schools, Quarry-green, Ayr.—In a limited competition for a new school at Quarry-green, Ayr, N.B., the Ayr School Board has selected the design of Messrs. Morris & Hunter, Ayr and London. The school, which is to be of two stories, is designed to seat 720 pupils, in 12 class-rooms of 60 each, grouped round a central staircase-hall. A feature of the plan is that each class-room will be lighted from the side, and a separate cloak-room has been provided for each of these rooms. Accommodation has also been secured for a future laboratory and demonstration-room, to seat 84 additional pupils. The building is plain in character, and the total cost will be about 5,000*l*.

BILLS IN PARLIAMENT AFFECTING THE METROPOLIS.

THE Bills in Parliament affecting the Metropolis are fewer than usual this year. There are, as usual, several tramway schemes, but with one or two exceptions they do not call for special remark, the rails being laid on the surface of the ground, and the roadway being undisturbed except in so far as it may be necessary for the purpose of laying the lines and paving between the rails.

The London, Camberwell, and Dulwich Tramways Company have introduced a clause into their Bill enabling the Company, when a certain portion of Rye-lane, Peckham, north of Choumert-road, shall have been widened, with the consent of the local authority, to open their tramway in Rye-lane.

The London Tramways Company propose to lay a new tramway over Westminster Bridge, and terminating in Bridge-street, Westminster, opposite the Westminster Bridge Station, Metropolitan District Railway.

The North London Tramways Company propose to extend their line along Holloway-road and Seven Sisters'-road, Islington.

The Vestry of the parish of St. Mary, Battersea, have introduced a Bill to obtain powers to deal with the allotment land known as Latchmere Allotment Grounds, Battersea. This land, which is situate between Battersea Park-road and Sheepcote-lane, has been used as garden ground for many years past; but in consequence of what Mr. Morris calls "the spreading of the hideous town," vegetation has not flourished there of late years, and it is now in contemplation to turn the land in question to some other purpose. It is provided by the Bill that the Vestry may sell the land or may lay it out for building. In the event of its being decided to lay out the land for building the Vestry is empowered to borrow the necessary money for laying it out on the security of the rates. The land proposed to be dealt with consists of upwards of 12 acres, and at a time when Londoners are expending large sums in the acquisition of open spaces, some protests may be expected to be made against this open space being absorbed.

A new railway is to be formed by the Bexley Heath Railway Company from Greenwich to Charlton. This railway will pass under Blackheath by a tunnel about three-quarters of a mile long, at a depth varying from about 100 ft. to 35 ft. below the surface of the ground.

The London and North-Western Railway propose to construct a widening to their line under Scrubs-lane, Hammersmith.

The South-Eastern Railway Company propose to form a short length of railway from the London and Greenwich Railway near Rotherhithe New-road to the North Kent Railway near the Bricklayers' Arms.

A Bill has been promoted for acquiring Raleigh House, Brixton-hill, and the houses Nos. 1, 2, 3, and 4, The Lawn, adjoining, for the purpose of forming a park; and another Bill (Vauxhall Park Bill) authorises the purchase of Carroun House and The Lawn for a similar purpose.

By the Kensington-square Improvement Bill it is proposed to form three new streets near Kensington-square.

Among the miscellaneous Bills may be mentioned the West Ham Corporation Improvement Bill, which will empower the Corporation to convert the Northern Outfall Sewer into a public promenade, to lay out and plant the same and form approaches thereto. This improvement was, if we do not mistake, originally suggested by the Public Gardens, &c., Association.

DISTRICT SURVEYORSHIPS.

ELECTION FOR DISTRICT OF EAST HAMPSTEAD.

AT the meeting of the Metropolitan Board of Works on the 10th inst., the first business taken was the election of a District Surveyor for East Hampstead, in the room of Mr. Alexander Peebles, who resigned the post on his election to the office of City Architect. Thirty-two candidates presented themselves, including Mr. C. Foulsham, who already held an appointment as District Surveyor.

Asked whether Mr. Foulsham or any other incumbent of a District Surveyorship could legally become a candidate for another District Surveyorship under the Board, the Solicitor (Mr. Ward) said he could see no legal impediment, and accordingly Mr. Foulsham's name was allowed to be put to the vote, after undertaking to resign his present appointment if the new one were conferred upon him. He only received 2 votes, however.

The following is a list of the candidates, with the number of previous applications by them for similar appointments under the Board, viz.:—Blackbourn, H., 6; Bridgman, H. H., 26; Brooker, J. W., 5; Cheston, H., 21; Coggin, C. T., 4; Cowper, P., 9; Eales, F. E., 8; Edwards, G., 13; Farrow, F. R., 6; Ferguson, J. M., 26; Francis, R. F. C., 13; Foulsham, C., —; Goodchild, J., 6; Gover, A. S., 2; Grellier, W., 27; Hamilton, F. W., 8; Hamilton, J., 16; Hamilton-Gordon, G., 11; Hardcastle, W. J., 13; Haslehurst, E., 15; Heyes, A., 8; Inskipp, G., 21; Jackson, G., 21; Lean, G. A., 18; Mountford, E. W., 5; Pelly, H. A., 11; Pownall, R. E., 12; Rawlins, H. A., 2; Saunders, M. L., 11; Slater, J., 4; Smallpeice, W., 27; and Stevens, W. H., 18.

The result of the preliminary ballot, to reduce the number of candidates to six, was as follows:—Bridgman, 11; Cheston, 11; Goodchild, 12; Grellier, 14; Hardcastle, 27; Saunders, 24; and Smallpeice, 30.

No candidate having thus received a majority of the votes of the members of the Board present (in accordance with the new mode of election), further ballots were taken, as follows:—

Second Ballot: Hardcastle, 15; Saunders, 11; Smallpeice, 22.

Third Ballot: Hardcastle, 18; Smallpeice, 26.

Mr. Smallpeice was therefore declared to be elected, and he thanked the Board for his appointment.

AN OLD DISTRICT DIVIDED INTO THREE.

At a subsequent stage of the Board's proceedings, the Hon. A. de Tatton Egerton, M.P. (Chairman of the Building Act Committee) reported, recommending, "That the vacant District of Clapham and the Southern District of Battersea,* be divided into three portions, to be designated "Clapham," "The Central Division of Battersea," and "The Southern Division of Battersea and the detached portion of Clapham," respectively; that the first-named district do consist of the parish of Clapham; that the second-named district do consist of that portion of the present district northward and westward of the boundary of the parish of Clapham, and northward of Clapham, and northward of Clapham Common and Battersea Rise; that the third-named district do consist of that portion of the parish of Battersea southward of Battersea Rise and westward of Clapham Common, together with the detached portion of Clapham; that the usual course be taken for filling the office of district surveyors for such districts; that advertisements be issued inviting candidates for the appointments; and that the Board do proceed to the election on Friday, February 24th, 1888."

This report was adopted.

* Vacant by the death of Mr. E. I'Anson, who had held it since 1844.

ARCHITECTURAL SOCIETIES.

Sheffield Society of Architects and Surveyors.—Mr. C. Hadfield, F.R.I.B.A., read a paper on Tuesday night to the members of the above society, on the position and attainments of the English architect. Mr. Flockton, President, presided, and there was a good attendance. A discussion ensued, in which Messrs. J. D. Webster, J. B. Mitchell Withers, J. H. Genn, and F. Fowler took part. A vote of thanks to the lecturer concluded the proceedings.

Edinburgh Architectural Association.—The usual fortnightly meeting of the Association was held on the 10th inst., the President, Mr. Hippolyte J. Blanc, in the chair. After the usual preliminary business, a paper on "The Mediæval Monastery and its place in the history of the Industrial Arts" was read by Professor G. Baldwin Brown, M.A. Emphasis was laid on the value of tradition in the practice of the industrial arts. Our recent failures in artistic matters, illustrated by the Jubilee coinage, which was in its own small way a national disgrace, showed that we had much ground to make up. The introduction of machinery seemed to have robbed us of much of the advantage which a continuous artistic tradition secured to the workers of the past. Nowhere could the working of sound artistic traditions be better studied than in the productions of the monastic workshops of the Middle Ages. These were generally excellent in style, and were much better models for the modern workman than brilliant but misleading examples like the bronze gates of Ghiberti, reproduced in all our museums. The general life of a Mediæval monastery would be illustrated from the data furnished on the famous plan of St. Gall; and ample details about the practice of the arts in conventual workshops were furnished by the "Schedula Diversarum Artium" of Theophilus. Bishop Bernward of Wildesheim, and the monk Tutilo of St. Gall, were examples of the monastic artist in different grades of rank. The artistic productions of the monastery were then reviewed, and the excellence in style of treatment and choice of motive explained by the close connexion in those ages of the industrial arts with architecture. Some technical details from Theophilus were added, and the paper closed with a few practical suggestions for the improvement of our artistic industries. A hearty vote of thanks was accorded to the Professor for his paper.

Glasgow Architectural Association.—On Saturday afternoon a large party of the members visited the Exhibition buildings, permission having been kindly granted by the architect, Mr. Sellar. The works are now so far advanced that a fair idea of their ultimate appearance may be gained. The visitors owed much to the kindness of the clerk of works, Mr. Shand.

THE ARCHITECTS', ENGINEERS', AND SURVEYORS' REGISTRATION BILL.

SIR,—It has come to our knowledge that a form of petition to the House of Commons, purporting to be the Petition of the Members of the Royal Institute of British Architects, in favour of the Bill drafted by the "Architects', Engineers', and Surveyors' Registration Act Committee" (introduced by Colonel Duncan, C.B., M.P., and read a first time on the 10th inst.), has been widely circulated. We desire, therefore, to make it known that such form of petition is wholly unauthorised by the Royal Institute of British Architects; and we venture to hope that members, in the interests of the general body, will abstain from signing the form sent to them.

J. MACVICAR ANDERSON, Hon. Secretary.
WILLIAM H. WHITE, Secretary.
Royal Institute of British Architects,
9, Conduit-street, W., Feb. 15.

THEATRE PLANNING.

SIR,—The time at my disposal at the Institute meeting was so short that I could not allude to much that had been said; perhaps you will allow me to add a few remarks. In the first place, as regards Mr. Tarver's patented plan of making the access to the tiers from the front, I wonder it did not occur to him that if so obvious an idea, which must present itself to every one who has planned a theatre, had hitherto been rejected, it was probably for some good reason. I had referred to it in these words,—"The entrance to all the upper parts of the house must be either at the top or the bottom, but never in the middle. It is far safer at the top, as there is less danger of falling in the rush to get into the corridors." The front of the dress circle is about 2 ft. 6 in. high. It is obvious that the greatest danger would ensue when the occupants of the various rows were jostling each other moving downwards on steps of wide, and, therefore, uncertain tread, and there would be a very great probability in a panic of the front ranks being pushed over the front. This is the most dangerous part of the exit, as some "jamming" is unavoidable, but when the movement is upward the danger is much lessened. Mr. Emden's plan at Terry's theatre of giving a door into the corridor from each row of the balcony is undoubtedly a good one, in spite of the objection to detached steps, but it is not applicable to any but a small theatre.

Mr. Tarver claimed increased accommodation for his plan. As far as the auditorium proper is concerned, all plans are on the same footing, the same superficial area per seat being required, the only opening for economy of space is in the arrangement of staircases.

It is difficult to make a comparison of this, as

circumstances always vary, but Mr. Tarver's chief plan, like Mr. Darbyshire's, proceeded on the principle that it is possible to get good carriage roads each side of the theatre.

I said, "Mr. Irving's plan not only requires space all round, but two good roads each side, suitable in capacity and direction for the procession of carriages; without such roads his plan collapses."

Mr. Darbyshire's answer seems to be: "Very well, get such roads." There are two suitable sites in London where it would be possible to get them,—the site of the Pavilion and of Waterloo House. Mr. Irving might afford these, but we must remember that Mr. Irving has taken to charging a guinea for his stalls, and I fail to see that that is any improvement at all in theatre management. If such sites can be obtained so much the better, but it would be absurd to say theatres should be built nowhere else.

From this and his other remark that the stalls must be on the ground-floor I do not think Mr. Darbyshire realises the conditions of London properties. I suppose there are no sites where it is not necessary to carry foundations and basement a long way below the ground line. Dressing-rooms and workshops are not allowed under the floor, so that unless part of the space be utilised by at least partly sinking the stalls, the cost of the building would be enormously increased. What is the objection? Surely it is better for the stalls to come up a staircase, which is a safe enough process, than to add another flight for all parts of the house to come down.

Mr. Darbyshire gives the distance to the back of the Lyceum Pit as 84 ft., but this includes an extra block of seats from which only 4 ft. 6 in. of the stage can be seen, and which is never used except for sitting down between the acts and enabling the office to say there is still sitting room. The distance to the back of the real pit is 64 ft. 6 in., and to that of Drury Lane 76 ft. Mr. Irving's new plan has a depth of 90 ft.

Mr. Darbyshire asks that fixed laws should be at once laid down as to the arrangement and construction of theatres. This is self-denying, as his scheme would certainly not be at present accepted. Against any attempt of the sort I wish to protest most strongly. Let us have sensible regulations administered by sensible people, but do not let us shut the door on improvements. If such strict laws had been laid down a few years ago they would certainly have proscribed concrete and prescribed the most dangerous forms of iron construction. After enduring public odium for years by refusing to bow the knee to the "iron construction idol," architects would be, indeed, foolish if after the ample manner in which they have been justified they were to allow any other tyranny to be set up that should arrest progress and improvement.

Ralph Nevill, F.S.A.

THE DURABILITY OF STAINED GLASS.

Sir,—Canon Lonsdale, of Lichfield Cathedral, in a letter to the *Times* of Feb. 1st, complained of the windows supplied by a certain firm being defective in the pigment used in painting the glass, and goes on to say that he made inquiries of other firms, of whom one assured him that a pigment had been discovered by a late member of their firm that would stand any test; but he does not, however, state as a proof of this assurance that a specimen of work executed with this pigment many years ago, and which had been exposed to London atmosphere ever since, was sent to him, and acknowledged by him in a letter to us (in his own words),—"That he had subjected it to the same severe tests he had applied to the ancient glass in the cathedral, and that the pigment seems thoroughly fused into the glass as if they were one substance." Surely this should satisfy his doubts whether the "art of properly mixing pigments or sufficiently firing glass has yet to be discovered." Anyhow, such a letter, which seems to suggest that all modern stained-glass painters are unacquainted with their business, should not be allowed to pass uncontradicted.

Heaton, Butler, & Bayne.

Pavement Lights.—Mr. Thaddeus Hyatt's "semi-prism" and ornamental tile and glass pavement lights are used in the new premises at the corner of Oxford and Wardour streets; also at Mr. Heath's new premises adjoining the Oxford-street portion of this block.

SANITARY REGISTRATION BILL.

Sir,—Your report of the above Conference [p. 106, *ante*] omits a most important resolution, carried in addition to those of Mr. Mark H. Judge, which was reported in the *Times* of Feb. 6th, viz.:—

"Mr. L. Angell then proposed the following, as an additional clause to the proposed Bill:—'That after January, 1890, it shall be unlawful for any building newly erected after that date to be let or occupied unless and until the sanitary arrangements have been certified in accordance with the Act.'

This proposal was supported by Mr. Janes, C.E., Surgeon-Major Pringle, and others, and was carried unanimously."

Lewis Angell,
Borough Engineer, West Ham.

The Student's Column.

IRON.

VII.—WROUGHT IRON.

THE chief effect of repeating rollings is that all the slag becomes squeezed out. Flawed iron is often produced from slag, which destroys the cohesion. If the slag becomes chilled in the centre of a mass placed under Nasmyth's hammer, the effect of hammering is simply to keep the slag more firmly in, until the mass is re-heated. Re-heating produces uniformity. The strong parts of a weak bar can be made to unite with the weak parts of a strong bar, and thus greater uniformity is obtained. Re-heating also produces fibre, by which best bar can be readily distinguished from rough bar. No. 3 iron is known as "best-best." The number of "bests" consists only of the number of re-heatings and re-rollings. If a pull be exerted upon a bar, the best bar will elongate more than an inferior bar. The fibre is thus seen to be intimately connected with the strength of the iron. When iron plates are rolled together, the best method is to place one row with the fibres arranged longitudinally, and the next row with the fibres arranged transversely, in order to obtain a kind of weaving action. The best bar only has the requisite ductility to be drawn into wire.

The question of the influence of the various ingredients of pig-iron upon the strength and quality of the metal is very complicated, and depends upon the relation to one another of the quantities of the substances present. In the absence of one or other, some other constituent may exist in greater proportion, and *vice versâ*. Pure carbide of iron or iron and carbon, in mixtures of the two, need not necessarily be the strongest, and would certainly not be the best material for many purposes.

	C.	Si.	S.	P.
Pig.....	2·275	2·720	0·031	0·645
Puddled (once rolling)	0·296	0·120	0·134	0·139

The latter are fagoted, re-heated, rolled, and then doubled, and again fagoted, re-heated, and rolled.

Wire	0·111	0·068	0·094	0·117

The puddling has produced certain chemical changes in the iron.

(1.) $Fe_3 + O_4$ combined to form $Fe_3\,O_4$.

(2.) $Fe_3\,O_4$ heated with C_4 will give $Fe_3 + 4\,CO$.

(3.) $Fe_3\,O_4 + Si$ will give $Fe + 2\,Fe\,O.\,Si\,O_2$.

For further changes we must refer our readers to the many excellent works dealing with the metallurgy of the subject, it being our object to make these articles as practical as possible.

In rolling iron the workman turns the bar half round before passing it through the next roll, and by this means greater uniformity is obtained. After leaving the rolls the iron bar or angle of open section is taken to the cutting-shears, and grasped by a pair of heavy tongs. The shearing-machine in well-arranged forges is placed near the finishing-rolls, as the general practice is to shear the iron hot. Stronger shears are required when the metal cools.

A high temperature is an indispensable condition to be observed in rolling. An experienced workman can judge by the appearance of the furnace, the best time to compress a pile of iron in the rolls.

A fibrous structure indicates a good iron. The fibrous structure is acquired in the rolling. You can only see the fibrous structure when you break a bar slowly. If you break it quickly it will appear crystallised. We may also note that it is quite possible to weaken a bar by too much forging or passing through the rollers. When bar-iron is heated in the air, the bar gets coated with oxide, which, at that high temperature, is liquid. One hundred parts of pig-iron will give ninety parts of puddled bars, so that ten per cent. is lost, which is not all iron, but consists of slag, and many impurities.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

1,811, Warming and Ventilating Public Buildings. J. D. Smead (U.S.A.).

In place of a fire in each room, fresh air from the outside is, by this invention, admitted into a heater resembling a locomotive boiler, with this difference, that the fresh air brought by a pipe or conduit from the outside of the building takes the place of the water, and is caused by the position of the entrance and exit pipes to largely traverse the boiler before escaping. After being thoroughly heated, traps or gratings admit the warm air to each apartment, while the vitiated air is drawn off by openings in the walls near the door, and passes through a hollow floor warming the boards and escapes by an exit shaft to the foul-air collecting-room. The fresh air is delivered or led to points near the ceilings of the rooms, and the admission is controlled by dampers or valves.

2,848, Plough and Sash Fillister Planes. W. Kimberley.

In the planes which are the subject of this invention, instead of the two arms with fence-piece, a threaded screw with a nut controls the fence, which by the turning of the screw may be moved away from or towards the plane itself.

3,220, Improved Regulators for Water-closets. H. L. Wetherell.

This invention relates particularly to that class of regulators in which the supply of water to the basin is automatically cut off thereat through the medium of a lever, the descent of which is controlled by the escape of air from a cylindrical chamber in which is contained a piston, the rod of which is hollow and attached to the said lever. An extra valve is used, placed near the lower end of the cylindrical chamber of the regulator, and free to open inwards. The escape of air is also controlled by a tap in the upper end of the piston-rod.

3,349, Parquet Flooring, &c. J. F. Ebner.

By this invention the undercut channels which formed an essential feature of a former patent are here formed by inserting strips of metal, the section of which is of dovetail shape. These metal channels are embedded in the cement, concrete, or other bed whilst in a plastic state, thus forming a metal lining to such channels or recesses. The under surface of the parquet or other flooring, or the blocks forming the same, are also formed with undercut recesses, so that when the two surfaces are combined the intervening cement or composition enters into the recesses above and below, and firmly secures them together.

3,789, Register Grates. H. Hunt.

The ordinary plain bottom grate is proposed by this invention to be replaced by a frame in which a series of round bars is arranged transversely. A grid having bars filled with firebrick or refractory composition is moved by a lever into such position that the combustion may be controlled according to the will of the operator.

3,890, Self-Acting Ventilator. J. Taylor.

The trunk of the ventilator which is the subject of this patent is square or rectangular in section, and passes through the roof in the ordinary way. About half way between the roof and the extreme top of the ventilator two sides of the trunk which are opposite to each other are projected outwards in a circular form in order that the cross section at this part may be three times the area of that of any other part above or below the two points where the projection begins. In the middle of the trunk at the projected part is inserted an angular or circular trough parallel to the two projecting sides of the trunk. Any rain or condensed steam which may drop into this trough is allowed to pass through one or both of the perpendicular sides of the trunk on to the slates of the roof; this trough being inserted in the middle of the projecting part of the trunk leaves the outlet on each side equal in area to the section of trunk above or below the points of projection. When the steam rises to the underside of the trough, the two outlets begin to contend against each other for an equal share of the work, and the result of this contrivance is a strong draught, which carries away steam or hot air very rapidly.

3,916, Saw Sets. T. Williamson.

This is a hand instrument of the tongs or pincers type. An octagonal plate with the edges bevelled according to the set of the teeth is forced against the teeth by pressure when drawing the handles together and gives the correct bevel or set to the teeth of the saw.

4,818, Metal Roofs. S. Taylor.

By this invention stepped roofing sheets are preferably used, and the longitudinal edges of the

stepped sheets have a convex beading or raised part, and a beading or gutter is formed at the extreme edge of the street by bending up at an obtuse angle. This first acts as a barrier to the passage of water, and the extreme edge being bent, it acts as a conduit for conveying water away which may have passed over the beading. A specially-formed fixing-cap is used where screws or other fastenings pass into the rafter to secure the sheets.

NEW APPLICATIONS FOR PATENTS.

Feb. 3.—1,612, W. Foulis, Fireplaces.—1,614, A. Dey, Chronographic Mechanism for Recording Times of Arrival and Departure of Workmen, &c.—1,616, R. McIntosh, Connecting Cesspools or Traps to Sinks, Water-closets, &c.—1,626, A. Beer, Frictionless Gate Springs and Release.—1,639, J. Gosney, Closing and Locking Doors of Rooms, Water-closets, &c.

Feb. 4.—1,667, E. Preston, Tools for Rebating, Grooving, and Moulding Wood, &c.—1,689, J. Smith, Portland Cement.—1,691, R. Affleck, Safety System of Lighting Theatres.—1,704, J. Robertson, Automatic Stopper for Gas, Steam, and Water Pipes.—1,714, A. Mitchell, Window Fastenings.—1,715, A. Mitchell, Securing Slates to Roofs.

Feb. 6.—1,717, P. Clark, Fire Stoves for Preventing Down-draughts in Chimneys.—1,753, A. Illidge, Indicator and other Fastenings for Doors.—1,754, G. Hamit, Securing Doors and Windows.—1,764, R. Stanley, Ovens or Kilns for Burning Bricks, Tiles, &c.

Feb. 7.—1,819, E. Lucas, T-squares.

Feb. 8.—1,862, J. Welch, Manufacture of Glass from Slate and Slate Waste.—1,880, J. Harley, Setting Saws.—1,893, S. Ridge, Door Springs.—1,918, G. Berry, Chimney Cowls.—1,924, G. Warden, Roofs.

Feb. 9.—1,934, G. & W. Richardson, Paperhangers' Pasting Machine.—1,949, N. Browne, Suspending Window Sashes, &c.—1,963, E. Dummer, Fire Grates or Stoves.—1,978, W. Joy, Manufacture of Cement.—1,979, G. Sharp and F. Turner, Cement suitable as Plaster and for Moulding.—1,980, M. Heys, Manufacture of Lime, &c.—1,983, H. Birkbeck, Portable Scaffolding.—1,990, G. Rogerson, Water-closets and their Flushing Pipes.—1,997, E. Dupont, Construction of Walls, Partitions, Roofs, &c.

PROVISIONAL SPECIFICATIONS ACCEPTED.

4,538, E. Munan, Fastener for Skylights, Flaps, &c.—10,221, W. Walker, Ventilating Buildings, &c.—17,294, C. Wright, Fastener for Windows, Doors, &c.—17,767, J. Archer, Material for Roofing, Door Panels, &c.—546, C. Wright, Fastener for Windows, Doors, &c.—736, C. Worssam, Adze or Cutter Block for Wood Planing.—1,062, G. Verini, Chimney Pots and Other Exit Terminals.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

4,278, W. Corbould, Manufactured Whiting.—4,300, A. McKechnie and G. Wicks, Apparatus for the Manufacture of Plumbers' Traps.—4,689, L. Preussner, Artificial Stone.—5,100, T. Robinson, Wood Planing Machines.—5,115, D. Cowan, Stoves or Detached Fireplaces.—5,153, G. and R. Clark, Flooring and Lining Iron and Other Buildings.—5,211, N. and L. Skelsey, Disinfecting Arrangement for the Pans of Water-closets.—5,253, J. Killey, Regulating the Discharge of Rain Water from Roofs.—5,374, J. Shepherd, Watertight Doors.—9,627, F. Pilkington, Fireproofing Columns, Stanchions, Girders, Ceilings, Walls, Floorings, or Buildings in any Position.—12,975, W. Horn, Door Latch.—16,014, R. Hall and J. Tinline, Fastening and Adjusting Knobs for Doors, &c.—334, H. Morgan, Attaching Sash Cords to Window-sashes, and in the Arrangement of Certain Parts of the Frames of Windows.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

FEBRUARY 6.

By FULLER, HORSEY, SONS, & CASSELL.

West Brompton—Ground-rent of 25*l.* a year, reversion in 44 years £720

FEBRUARY 7.

By H. RUTLEY.

Finsbury Park—113, Isledon-road, 72 years, ground-rent 7*l.* 15s. 350

Regent's Park—93, William-street, 34 years, ground-rent 6*l.* 460

By DRIVER & CO.

Pimlico—9, Hanover-street, 37 years, ground-rent 7*l.* 500

FEBRUARY 8.

By BAXTER, PAYNE, & LEPPER.

Kennington Park-road—No. 216, subject to life aged 56 years, ground-rent 4*l.*, and a policy for 700*l.*, life aged 56 years 715

Kennington Park-road—No. 420, subject to a life aged 56 years, ground-rent 4*l.*, and a policy for 700*l.* on same life 560

Kennington Park-road—No. 418, subject to same life, and a policy for 600*l.* on same life 455

By T. WRIGHT.

Beckenham, Lennard-road—St. John's Villa, 84 years, ground-rent 5*l.* 15s 465

Anerley, Avenue-road—Yberg Villa, 74 years, ground-rent 8*l.* 15s. 690

By T. G. WHARTON.

(On the Premises.)

Putney—19 and 21, Norroy-road, in carcass, 99 years, ground-rent 16*l.* 16s. 275

FEBRUARY 9.

By C. C. & T. MOORE.

Bow-road—No. 54, term 65 years, ground-rent 6*l.* ... 660

Regent's Park—Ground-rents of 16*l.*, reversion in 42 years 475

Ground-rents of 9*l.*, reversion in 63 years 235

Ground-rents of 24*l.*, reversion in 42 years 705

Mile End—23 and 24, Allas-road, 78 years, ground-rent 8*l.* 8s. 410

By W. W. JENKINSON.

Brighton—3 and 8, Medina-terrace, copyhold 4,460

By B. BROWN.

Poplar—29, 31, and 33, Pennyfields, freehold 800

Old Ford—79 to 85, odd, St. Stephen's-road, freehold 630

115 and 117, St. Stephen's-road, freehold 500

74 and 76, Ford-road, freehold 475

14 to 32, even, Ford-road, 65 years, ground-rent 18*l.* 1,615

By W. T. KNIGHT.

Bromley-by-Bow—50 and 52, Tetley-street, 50 years, ground-rent 4*l.* 4s 305

Ripplesde, Barking—Hatfield Cottage, freehold ... 255

Forest Gate—241A, Romford-road, freehold 750

By W. A. BLAKEMORE.

Notting Hill—10, Mortimer-terrace, 74 years, ground-rent 5*l.* 17s. 260

By G. A. BICKERTON.

Stockwell—324, South Lambeth-road, 48 years, ground-rent 7*l.* 430

By E. STIMSON.

Vauxhall—22, Glynn-street, 77 years, ground-rent 6*l.* 310

Bloomsbury—42, Hunter-street, 18 years, ground-rent 26*l.* 5s 200

Commercial-road, E.—82, Christian-street, 12 years, ground-rent 5*l.* 5s. 150

10 and 11, Bermuda-street, 5 years, ground-rent 7*l.* 55

Mile End—90, Jubilee-street, 12¾ years, ground-rent 4*l.* 120

FEBRUARY 10.

By BAKER & SONS.

Goswell-road—No. 250, term 39½ years, ground-rent 20*l.* 605

Wimbledon—68, 71, and 72, High-street, and the Wimbledon Brewery, with the goodwill, 96 years, ground-rent 130*l.* 2,700

Chelsea—The lease of 24, Cheyne-row, term 6½ years 57

MEETINGS.

SATURDAY, FEBRUARY 18.

Architectural Association.—Visit to the Great Northern Hospital, Holloway-road. (See advt. on first page in last week's issue.)

Finsbury Technical College.—Conference of Carpenters and Joiners on Technical Education.

MONDAY, FEBRUARY 20.

Royal Institute of British Architects.—Mr. Lawrence Harvey on "Masonry for Architectural Students." 8 p.m.

Royal Academy.—Mr. A. S. Murray on "Sculptures recently Discovered in the Acropolis of Athens." 8 p.m.

Surveyors' Institution.—Resumed discussion on Mr. R. F. Grantham's paper on "Water Supply." 8 p.m.

Clerks of Works' Association.—Fifth annual dinner, Mr. Banister Fletcher, F.R.I.B.A., in the chair. St. James's Hall Restaurant. 7 p.m.

Leeds and Yorkshire Architectural Society.—Paper by Mr. Aston Webb. 7·30 p.m.

TUESDAY, FEBRUARY 21.

Institution of Civil Engineers.—(1) Further discussion on Mr. J. Pierce's paper on "The Economic Use of the Plane-Table in Topographical Surveying." (2) Papers by Mr. R. A. Hadfield on "Manganese in its Application to Metallurgy," and "Some Novel Properties of Iron and Manganese." 8 p.m.

Statistical Society.—Mr. J. G. Colmer on "Canadian Railway and Commercial Statistics." 7·45 p.m.

Manchester Architectural Association.—(1) Paper by Mr. W. C. Tuke. (2) Nomination of Officers. 7·30 p.m.

Museum of Archæology, Cambridge.—The Rev. G. F. Browne, B.D. (Disney Professor), on "Sculptured Stones of pre-Norman Type in the British Islands," IV. 2·30 p.m.

WEDNESDAY, FEBRUARY 22.

Society of Arts.—Mr. Swire Smith on "The Technical Education Bill." 8 p.m.

Liverpool Engineering Society.—Mr. J. A. Saner on "Flood-gates and Weirs on the river Weaver." 8 p.m.

THURSDAY, FEBRUARY 23.

Royal Academy.—Mr. A. S. Murray on "Ancient Engraved Gems" 8 p.m.

London and Middlesex Archæological Society (St. John's Gate, Clerkenwell).—Mr. E. Freshfield on "Some Observations on St. John's Gate and its Associations." 8 p.m.

Society of Telegraph-Engineers and Electricians.—Herr R. Von Fischer Trenenfeld on "The Present State of Fire-Telegraphy." 8 p.m.

Society of Antiquaries.—8 p.m.

Edinburgh Architectural Association.—Address by Professor Blackie. 8 p.m.

FRIDAY, FEBRUARY 24.

Institution of Civil Engineers (Students' Meeting).—Mr. A. J. Knowles, B.A., on "The Erection of the Superstructure of the Forth Bridge." 7·30 p.m.

Royal Institution.—The Very Rev. G. Granville Bradley, D.D., Dean of Westminster, on "Westminster Abbey." 9 p.m.

Miscellanea.

Obituary: Mr. W. L. Gomme.—We have to record the death of Mr. W. L. Gomme, architect, of Hammersmith. He was architect to the original Foresters' Hall, Wilderness-row, Clerkenwell, a greater part of which was taken down in 1875 for the purposes of enlargement. Mr. Gomme was principally known in London in connexion with the London United District of the Ancient Order of Foresters.

Trade Conferences.—A Conference of Representatives of the Bricklaying Trades, was held on Wednesday evening at the Finsbury Technical College, in continuation of the series of Trade Conferences which have been held during the present winter. All branches of the trade were represented, and several members of the Council of the Bricklayers' Society were on the platform. Mr. J. Rowlands, M.P., who presided, referred at the opening to the great importance of Technical Education, and to the proposed Bill, which will be laid before Parliament during the present Session. As he understood the matter, the real sort of technical instruction did not consist in setting an unpractical schoolmaster to teach trade classes, but was entrusted to thoroughly practical men who should teach to those who were growing up in their trade the principles underlying their craft. He believed that the authorities of the Finsbury Technical College were awake to this matter, and were shaping their courses of instruction in a thoroughly practical way. Mr. H. W. Richards, instructor of the classes in bricklaying and brick-cutting, read a paper on "Technical Education for Bricklayers." In the discussion which followed many members took part, including Mr. J. Toomey, chairman of the Operative Bricklayers' Society; Mr. Chambers, Mr. Hancock, Mr. Williams, Mr. Millis, Mr. Jeffrey, and Prof. Thompson (Principal of the Finsbury Technical College). The following resolution was unanimously passed:—

"That this Conference approves of the methods of instruction adopted at the Finsbury Technical College, and believes that if the technical schools throughout the country will adopt and confine themselves to the same line they will be rendering a great service to the bricklaying trade."

This Saturday, the 18th inst., another Conference will be held, this time of Carpenters and Joiners, under the presidency of Mr. W. R. Cremer, M.P.

Osney Bridge, Oxford.—Tenders have been accepted for the reconstruction of this bridge across the Thames at Oxford, according to plans prepared by Mr. W. H. White, M.Inst.C.E., Engineer to the Local Board. The new bridge will consist of one cast-iron arched span of 60 ft. and two smaller stone arches. The abutments, wing walls, and parapets will be of stone, the ashlar being Derbyshire grit stone. The centre span will have ornamental cast-iron side railings, and the roadway will be carried by Lindsay's patent rolled steel trough flooring, covered with cement concrete. The contractor for the piled foundations, concrete, and masonry is Mr. W. J. McKenzie, of Wandsworth; and for the ironwork the Horseley Company, Tipton, the total cost being about 3,750*l.* The removal of the ruins of the old structure has been commenced.

The Late Sir John Harpur Crewe, Bart.—A memorial tablet from the studio of Mr. Boehm, R.A., has just been erected in Calke Abbey, Derby, to the memory of the late Sir John Harpur Crewe, Bart. The memorial is 10 ft. high and the material alabaster and marble. The design consists of three divisions, the centre containing a medallion portrait of the late baronet, said to be a very faithful likeness, beneath which is the inscription panel, and above the family arms. The whole is backed by dove marble, which brings out the highly carved and pierced alabaster admirably. The design is by Mr. Ince, King William-street, Strand, and has been carried out by Mr. Henry Terry, of Loughborough Junction, Brixton.

The National Training School of Cookery.—This society was formed in pursuance of certain resolutions adopted by a meeting held at Grosvenor House on July 17, 1873. Inasmuch as they must soon give up their present premises at South Kensington, the society are about to acquire from the Duke of Westminster a site in the Buckingham Palace-road for new and larger kitchens and schools. It is further proposed that the society shall be incorporated as a company, limited by guarantee, to which end a meeting will be held at three p.m. on the 22nd inst., at Lady Burdett-Coutts's house, No. 1, Stratton-street, Piccadilly.

The Clerks of Works' Association of Great Britain.—The fifth annual dinner of this Association will take place at the St. James's Hall Restaurant, on Monday next, Mr. Banister Fletcher, F.R.I.B.A., in the chair.

Removal.—Mr. J. C. Edwards, of Ruabon, has removed his London Offices from 24, Charing-cross, to Argyle-chambers, 86 and 87, Strand, W.C.

American Strikes and Lock-outs.—In the third annual report of the American Bureau of Labour Statistics, Commissioner C. D. Wright reports the following strikes and lock-outs in the United States for the six years ending December 31, 1886:—1881, 471 strikes, involving 2,928 establishments; 1882, 454 strikes, in 2,105 establishments; 1883, 478 strikes, in 2,759 establishments; 1884, 443 strikes, in 2,367 establishments; 1885, 645 strikes, in 2,284 establishments; 1886, 1,412 strikes, in 9,893 establishments. The increase in strikes in recent years is remarkable, and another noteworthy feature in these stoppages of industry is that the strikes and number of establishments affected in New York alone during the period formed almost one-half of the above totals. The total number of employés involved in the strikes during the six years was 1,318,624, and the number of employés originating the strikes was 1,020,832. The number of workers employed in the affected establishments before the strikes occurred was 1,662,045, and after the strikes 1,636,247, involving loss of employment to 25,798 workers. There were 103,038 new employés engaged after the strikes, and 37,483 were brought from other places. Lock-outs were ordered in 2,182 establishments during the six years. There were 173,995 workers employed before the lock-outs, and 169,436 after, while the number actually locked out was 159,548. There were 13,976 new employés engaged at the close of the lock-out, and 5,682 were brought from other places. Of the strikes which took place, 82 per cent. were ordered by labour organisations, and of the lock-outs, 81 per cent. were ordered by combinations of manufacturers. Of the total strikes, 46½ per cent. were successful, 13½ per cent. were partially successful, and about 40 per cent. failed. Of the lock-outs ordered, nearly 26 per cent. were successful, 9 per cent. succeeded partially, and 60 per cent. failed. The demand for increase of wages was the cause of 42 per cent. of the strikes; 19 per cent. were for shorter hours, and 8 per cent. against reduction of wages. For shorter hours and higher wages, 7½ per cent. struck. The cost of the strikes to employés in loss of wages during the six years was $51,816,165, and of the lock-outs $8,132,717, or a total loss of wages of $59,948,882. The total loss to employers was $34,164,914, of which $30,732,658 was caused by strikes and the balance by lock-outs.

Extensions at Queen Anne's Mansions. The lofty pile of buildings at Queen Anne's Gate, overlooking St. James's Park, which was erected some years since by Mr. H. A. Hankey, are about to be considerably enlarged, the whole of the tenements in the existing buildings being now fully occupied. These buildings are the loftiest and ugliest of any similar structures in the metropolis, containing twelve stories, and carried to a height of about 100 ft. The flat roof at the top forms a fine promenade, commanding on clear days a panoramic view around London and the home counties for many miles distant. There are large and convenient lifts from the ground to the several floors above, which are kept in constant operation throughout the day. The numerous suites on the several floors contain apartments varying from two and three upwards, the rentals ranging from 60*l.* to 200*l.* and 300*l.* per annum. At the time the buildings were erected their unusual height was opposed by the Metropolitan Board of Works on the ground that in case of fire it would be impossible to reach the upper floors with water; but in answer to this objection Mr. Hankey, who was his own architect, stated that with the supply of water in the tanks at the top of the building, and the hydrants on the several floors the entire building could be drowned, so to speak, in case of need, in a few minutes. We hear that Mr. E. R. Robson has been appointed architect for the extensions.

Proposed Museum, King's Lynn.—A deputation of some of the leading inhabitants of this town, headed by Mr. Beloe, the archæologist, waited upon the Town Council on the 9th inst. to induce them to lend a sum of money and give a site towards the building of a new museum from plans prepared by Mr. W. Adams, architect, King's Lynn. Some opposition was shown against lending any money for the purpose, but it was ultimately agreed to give the site, and the matter was referred to the Property Committee.

British Archæological Association.—At the meeting of this Association, on the 1st inst., Mr. Cecil Brent, F.S.A., in the chair, Mr. W. G. Smith reported the discovery of prehistoric remains at Dunstable, and exhibited a photograph of a skeleton in the posture in which it had been found. The proposed repair of the village cross at Sevington was considered, and a view exhibited. It stands at the junction of three roads, and it is proposed to clean and point it. The cross at Braithwell, near Doncaster, has been similarly dealt with, and the completion of the work as a Jubilee Memorial was reported. No attempt has been made to restore the curious inscription. Mr. Loftus Brock, F.S.A., exhibited a series of ancient engravings of the antiquities of Rome, showing their appearance in the latter part of the sixteenth century. Mr. H. Cole, of Winchester, exhibited a large and fine collection of rubbings of brasses taken by a process invented by himself, by which the exact appearance of the brass is rendered, and all enamel colours, when they occur, can also be reproduced. Dr. Walker, of Peterborough, sent for exhibition a remarkable bronze equestrian figure of Roman date in perfect preservation. It was found not long since in the neighbourhood of Peterborough. The group, horse and rider, is of small size, the horse being supported on a bronze disc by the hind legs only. A paper was then read on the original design of the west front of Peterborough Cathedral, by Mr. J. T. Irvine. Attention having been called to the imperfect design of the three gables over the large arches of the front, the lecturer referred to the curious fact that the stonework showed evidences of having been originally prepared for some larger arrangement of niches and circular windows. These portions touch one another, and in some places the stones are actually cut through, irrespective of the pattern, to make them fit into their present positions. A large drawing was exhibited showing the author's idea of what the original design of the master mason had been. A second paper on Ancient Wardrobes and Wardrobe Tallies, by Mr. H. Syer Cuming, F.S.A., was then read. Some curious examples of mechanical contrivances for keeping accounts of articles of wearing apparel were referred to at length.

Washable Wall-Coverings.—We have received from Messrs. Fisher & Co., of 33, Southampton-street, Strand, some specimens of their washable wall and ceiling coverings. Their "Muraline" is a stout paper, with the decorated surface finished in oils and therefore non-absorbent. This is sold at 6d. per yard, 24 in. wide. "Duro-Textile" is another wall-covering of similar character, but instead of being of paper it is, as its name implies, a woven fabric, and it is, therefore, well adapted for covering ceilings over plaster. The surface is printed in oils. This material is sold at 1s. per yard, also 24 in. wide. Messrs. Fisher & Co. have also submitted to our notice designs and samples of their "Embossed Tapestry" wall-covering (which has the raised or embossed parts of the figure filled in at the back with a waterproof cement, so as to preserve the form). With this material very rich decorative effects are obtainable at a moderate cost. Like the other materials we have named, it is, to a certain extent, washable. The same remark also applies to Messrs. Fisher's "Crêpe Muraline," by the use of which some of the richness of "raised flocks," without their sanitary disadvantages, is obtained. All these productions are likely to become better known than they are at present, for we understand that a company to undertake their manufacture on an extended scale is in course of formation. We may add that the smoking-room at the Grand Hotel, Charing Cross, and one of the landings of the same building, have lately been covered with "Muraline Brocade," another production of the same firm, with very good effect. All the wall-coverings we have named can be readily hung by an ordinary paper-hanger. In regard to their "washable" quality we have no doubt they are perfectly washable within certain limits of endurance. The question in regard to all the papers that are called washable is, how many washings will they stand?

Normanton-on-Soar.—The Wesleyans are about to build a chapel in this village. It will seat 130 persons, and a school at the rear for fifty children. Mr. Wills, of Derby, is the architect.

Sanitary Assurance Association.—The seventh annual meeting of the members of this Association was held at their offices, 5, Argyll-place, Regent-street, on Monday last. In the unavoidable absence of the President (Sir Joseph Fayrer), Professor Roger Smith, F.R.I.B.A., presided. Mr. Joseph Hadley read the annual report, which was taken up in part with the proceedings in connexion with the Sanitary Registration Bill. The income for the year was 444*l.* 10s., and a balance was brought forward after meeting all liabilities. We quote the following from the report:—"The properties inspected and certified during the year have, as usual, been of the most varied character, and in no case of first inspection have the sanitary arrangements been found to be such as could be certified without alteration; but it is satisfactory to report that with newly-built property there is a continued improvement, necessitating fewer alterations to secure the sanitary certificates. Annual inspections for the renewal of sanitary certificates continue to be made. These annual inspections are only second in importance to the first inspections, and the certificates of the Association have now in some cases been in force for seven years." The Chairman proposed the adoption of the report, and expressed his satisfaction at the continued prosperity of the Association. Mr. Andrew Stirling seconded the adoption of the report, which was unanimously passed. Mr. Mark H. Judge, A.R.I.B.A., proposed "That the Right Hon. Lord Chelmsford, G.C.B., be requested to take charge of the Sanitary Registration Bill in Parliament this Session, and to introduce the Bill into the House of Lords at as early a date as possible." Sir Peter S. Lumsden, G.C.B., seconded this resolution, which was supported by Mr. H. Rutherfurd, barrister-at-law, Dr. Willoughby, and others, and carried unanimously. The retiring members of the Council were re-elected. Sir Joseph Fayrer was re-elected President of the Association, and Professor T. Roger Smith was re-elected Vice-President.

New Town-hall, Motherwell, N.B.—A new Town-hall and Municipal offices have just been opened at Motherwell. The building, which is English Renaissance in style, and has a massive clock tower, 120 ft. high, comprises a town-hall, seating 1,200, a lesser hall and court-room, with committee and witnesses' rooms, council chamber, Town Clerk and Burgh Surveyor's offices, with other offices for letting, fire-engine station, &c., and will cost, with fittings, &c., upwards of 6,000*l.* The architect is Mr. John B. Wilson, A.R.I.B.A., Glasgow, whose design was selected in competition. The Town-hall was illustrated in the *Builder* for October 16, 1886.

New County Buildings for Renfrewshire.—At a special meeting of the Commissioners of Supply for the county of Renfrew, recently held at Paisley, it was resolved to acquire an additional property adjoining the new Court-houses, Paisley, at a cost of 1,300*l.*, so as to enlarge the site for the new county buildings to be erected there. Mr. Alexander Crum (ex-M.P.), of Thornliebank, who presided, stated that, with this addition, the cost of the buildings and site would be 21,700*l.* They had on hand 10,000*l.* from various sources, and could provide for the remaining 11,700*l.* by assessment of little more than 3d. spread over two or three years.—*Scotsman.*

The New Workhouse Infirmary, Birmingham.—The extensive buildings, which are now being erected from the designs of Mr. W. H. Ward, architect, of Birmingham, at a cost of 60,000*l.*, are being warmed and ventilated throughout by means of Mr. E. H. Shorland's patent "Manchester" Stoves, with descending smoke-flues.

Mylor, Cornwall.—The new school building at Mylor, built from the plans of Mr. J. Wm. Trounson, architect, Penzance, has just been opened. It forms either one apartment, or a central hall and several class-rooms when the revolving screens are used. The contractors were Messrs. Thos. Rickard & Son, Penryn.

PRICES CURRENT OF MATERIALS.

TIMBER.	£. s. d.	£. s. d.
Greenheart, B.G. ....ton	6 10 0	7 15 0
Teak, E.I. ....load	8 0 0	12 10 0
Sequois, U.S. ....foot cube	0 2 3	0 3 0
Ash, Canada ....load	3 0 0	4 10 0
Birch ,, ...	2 0 0	3 10 0
Elm ,, ...	3 10 0	4 10 0
Fir, Dantsic, &c.	1 10 0	4 0 0
Oak ,, ...	2 10 0	4 10 0
Canada	3 0 0	6 0 0
Pine, Canada red	2 0 0	3 10 0
,, yellow	2 0 0	4 0 0

TIMBER (*continued*).	£. s. d.	£. s. d.
Lath, Dantsic .....fathom	3 0 0	5 0 0
St. Petersburg	4 0 0	5 10 0
Wainscot, Riga .....log	0 0 0	0 0 0
Odessa, crown.....	2 10 0	3 0 0
Deals, Finland, 2nd and 1st...std.100	7 10 0	9 0 0
4th and 3rd.....	6 0 0	8 0 0
Riga	5 10 0	7 10 0
St. Petersburg, 1st yellow	8 10 0	14 0 0
2nd	7 0 0	8 0 0
white	6 10 0	8 10 0
Swedish	6 15 0	15 0 0
White Sea	7 0 0	16 10 0
Canada, Pine, 1st	16 0 0	24 0 0
2nd.....	10 0 0	15 10 0
3rd, &c.....	7 0 0	9 10 0
Spruce, 1st	8 0 0	9 10 0
3rd and 2nd.....	5 0 0	7 0 0
New Brunswick, &c.....	5 0 0	7 0 0
Battens, all kinds	4 0 0	10 10 0
Flooring Boards, sq., 1 in., prepared, First.....	0 8 0	0 11 6
Second	0 6 6	0 7 6
Other qualities	0 4 0	0 6 0
Cedar, Cuba .....foot	0 0 3½	0 0 3½
Honduras, &c.	0 0 3	0 0 3½
Australian	0 0 2	0 0 3
Mahogany, Cuba	0 0 4½	0 0 7
St. Domingo, cargo average	0 0 4½	0 0 6
Mexican ,, ...	0 0 3½	0 0 3¾
Tobasco ,, ...	0 0 4	0 0 5
Honduras ,, ...	0 0 4	0 0 5
Maple, Bird's-eye	0 0 5	0 0 7
Rose, Rio .....ton	8 0 0	11 0 0
Bahia.....	7 0 0	9 0 0
Box, Turkey	5 0 0	12 0 0
Satin, St. Domingo .....foot	0 0 5	0 0 9
Porto Rico	0 0 6	0 0 10
Walnut, Italian	0 0 4	0 0 5½

METALS.	£. s. d.	£. s. d.
IRON—Bar, Welsh, in London...ton	0 0 0	0 0 0
,, ,, in Wales	0 0 0	0 0 0
,, Staffordshire, London	0 0 0	0 0 0
COPPER—		
British, cake and ingot .....ton	77 0 0	0 0 0
Best selected	78 0 0	79 0 0
Sheets, strong.....	90 0 0	0 0 0
Chili, bars	77 0 0	77 10 0
YELLOW METAL.....lb.	0 0 7½	0 0 7⅝
LEAD—		
Pig, Spanish .....ton	14 12 6	14 15 0
English, common brands.....	0 0 0	0 0 0
Sheet, English	15 17 6	16 2 6
SPELTER—		
Silesian, special .....ton	19 0 0	19 15 0
Ordinary brands.....	19 0 0	19 5 0
TIN—		
Straits.....ton	166 10 0	0 0 0
Australian	166 10 0	0 0 0
English ingots	160 0 0	0 0 0

OILS.		
Linseed .....ton	18 17 6	19 2 6
Cocoanut, Cochin	28 0 0	29 0 0
Ceylon	24 15 0	25 0 0
Palm, Lagos	22 0 0	0 0 0
Rapeseed, English pale	25 0 0	25 5 0
,, brown	23 15 0	0 0 0
Cottonseed, refined	20 10 0	0 0 0
Tallow and Oleine.....	25 0 0	45 0 0
Lubricating, U.S.....	5 0 0	6 0 0
,, refined.....	5 0 0	12 0 0
TURPENTINE—		
American, in casks .....cwt.	1 9 6	0 0 0
TAR—		
Stockholm .....barrel	0 15 0	0 15 6
Archangel	0 10 0	0 10 6

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Technical School, Blackburn.....	The Building Committee	1st, to carry out work; 2nd, 100*l.*; 3rd, 50*l.*	April 14th	ii.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Road-making Works, Loughborough	Trustees Storer's Charity	W. E. Woolley.....	Feb. 20th	ii.
Rolled Iron Joists and Girders	Cambridge County Lunatic Asylum.....	R. R. Rowe.....	Feb. 25th	ii.
Removal of present Jetty and Constructing a new one at Chelsea	Vestry of St. Mary Abbotts, Kensington...	W. Weaver	Feb. 27th	ii.
Works and Materials	do.	do.	do.	ii.
Tar Pavements	Littlehampton Local Bd.	H. Howard.....	do.	ii.
Paving Works	do.	do.	do.	ii.
Works and Materials	Hendon Local Board ...	S. S. Grimley	do.	xi.
Wood Paving	Chelsea Vestry.....	G. R. Strachan.....	Feb. 28th	xi.
Sewerage Works, Shoreham, Kent	Sevenoaks R.S.A.	T. Hennell	do.	xi.
New Play Sheds, Iron Fencing, &c.	Walthamstow School B.	W. A. Longmore.....	do.	xi.
Fire Brigade Station.....	West Ham Council.....	Lewis Angell	do.	xi.
Paving Footways	Greenwich Bd. of Wks.	*Official*	Feb. 29th	xi.
Urinal	do.	do.	do.	xi.
Works and Materials	Hammersmith Vestry...	do.	do.	xi.
Removal of Street and House Refuse.....	do.	do.	do.	xi.
Raising Vestry's Wharf, &c.	do.	do.	do.	xi.
Pauper Lunatic Asylum, Plymouth	Com. of Justices	Hine & Odgers.....	March 2nd	ii.
Works at Sanitary Depot	Hornsey Local Board...	T. De Courcy Meade ...	March 5th	ii.
Works and Materials	do.	do.	do.	xi.
Watering, Cartage, and Road Material	Leyton Local Board ...	*Official*	March 6th	xi.
Wrought-Iron Fencing, &c.	Met. Board of Works...	do.	March 7th	xi.
Works and Repairs to Buildings	Com. of H.M. Works...	do.	March 13th	ii.
Board School Buildings, Douglas (I. of M.)...	The School Committee	Bleakley & Cubbon.....	Not stated...	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page
District Surveyors.....	Met. Board of Works...	Not stated	Feb. 22nd	xvi.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *Noon on Thursdays.*]

BRANTHAM (Suffolk).—For the erection and completion of tap and club room at the Buck's Horns, Brantham, Suffolk, near Manningtree, for Messrs. Daniell & Sons' Breweries (Limited). Mr. J. W. Start, architect, Cupschambers, Colchester:—

W. Wheeler, East Bergholt	£552 17 5
F. B. Capon, Manningtree	448 17 6
Thomas Towell, Lawford	420 0 0
Alfred Coe, Ipswich	417 10 0
Saunders & Son, Dedham.....	415 0 0
J. Harden, Colchester	409 0 0
A. Diss, West Bergholt.....	400 0 0
Gladwell & Son, Manningtree	398 10 0
H. Ambrose, Colchester	389 17 5
Oliver T. Gibbons, Ipswich	375 0 0
F. Dupont, Colchester (accepted).....	357 0 0

CLERKENWELL.—For the construction of a roof, &c., over the premises in the rear of 21, Gloucester-street, for Mr. William Henry Musgrave. Mr. William A. Burr, architect, 65, Chancery-lane, W.C.:—

Hunt.....	£533 0 0
Barton	525 0 0
Larke & Son	407 10 0
Leslie & Knight	368 15 6
Stevens Bros., 148, Seven Sisters-road*	320 10 0

* Accepted.

DARENTH.—For oak fencing work, walling, &c., at the Gore Farm Hospital at Darenth, near Dartford, Kent, for the Metropolitan Asylums Board. Messrs. A. & C. Harston, architects, 15, Leadenhall-street, E.C.:—

W. Johnson	£1,216 0 0
Barrett & Power	1,174 0 0
W. & E. Wallis.....	1,066 0 0
Beadle Bros.....	1,035 0 0
W. Nash.....	1,015 0 0
J. Knight	959 0 0
Langton	953 0 0
J. Wood	935 0 0
Rowland Bros.	884 15 0
Turner & Co., Limited	867 0 0
Taylor & Brooker, Dorking*.....	794 0 0

* Accepted.

DARENTH.—For roadmaking work at the Gore Farm Hospital, at Darenth, near Dartford, Kent, for the Metropolitan Asylums Board. Messrs. A. & C. Harston, architects:—

J. E. Bloomfield	£1,799 0 0
Turner & Co., Limited	1,300 0 0
G. Osenton, Westerham*	1,196 0 0

* Accepted.

EASTCHEAP.—For office-fittings at St. George's House, for Messrs. Isaacs & Son. Mr. William A. Burr, architect:—

Smith & Co., 158, High-street, Boro.*	£297 0 0

* Accepted.

FULHAM.—For building a reading-room and other works at the Free Public Library. Mr. John G. Hall, architect. Quantities by Mr. F. H. A. Hardcastle:—

R. Edwards & Co.....	£3,779 0 0
S. Knight.....	3,350 0 0
Scharien & Co.	2,983 0 0
F. R. Tozer.....	2,956 0 0
W. H. Smith	2,949 0 0
M. Macey & Sons	2,878 0 0
F. R. Turtle	2,870 0 0
W. A. Rhodes	2,790 0 0
Chas. Humphreys	2,735 0 0
Alfred Brickell.....	2,726 0 0
F. & F. H. Higgs	2,686 0 0
J. T. Chappell	2,648 0 0
B. E. Nightingale.....	2,588 0 0
W. H. Ashfold	2,495 0 0
R. & S. Parker	2,493 0 0
C. Wall (accepted)	2,484 0 0
G. Stephenson (too late)	2,436 0 0
L. Whitehead (too late)	2,820 0 0

FULHAM.—For supplying and laying down about 4,735 yards super. of wood pavement in a portion of the King's-road, between Stanley Bridge and Waterford-road, Fulham, for the Vestry of Fulham. Mr. James P. Norrington, surveyor:—

W. G. Coat.....	£2,080 0 0
Nowell & Robson.....	2,047 0 0
J. Alldred	2,030 0 0
Mowlem & Burt.....	2,015 0 0
A. Brickell.....	1,953 0 0
Muldoon Bros.	1,940 0 0
Biggs & Co., Birmingham.....	1,940 0 0
Turner & Sons	1,890 0 0
Treherne & Co.	1,854 0 0
Improved Wood Paving Co.	1,794 0 0

HAMPSTEAD.—For shop-fittings at Fitzjohn's-parade, for Messrs. Welford & Sons. Mr. William A. Burr, architect:—

Smith & Co., 158, High-street, Boro.*	£120 0 0

* Accepted.

HARROW.—For the erection of a cemetery chapel and lodge at Harrow, for the Burial Board of Harrow. Messrs. Ernest George & Peto, architects. Quantities by Messrs. Stoner & Sons:—

	Chapel.	Lodge.	Total.
Turner	£1,048 0	... £524 0	... £1,572
Howell & Son	970 0	... 530 0	... 1,500
Jones	1,000 0	... 490 0	... 1,490
Melton & Wallis ...	990 0	... 465 0	... 1,455
Judge & Eames.....	990 0	... 492 0	... 1,482
T. Pearce.....	1,001 0	... 475 0	... 1,476
Jenvey & Co.....	969 16	... 481 14	... 1,451
Nash	945 0	... 475 0	... 1,420
G. Gibson	924 0	... 450 0	... 1,374
Newton & Idle	909 0	... 455 0	... 1,364
David Brown	900 0	... 454 0	... 1,354
Robson.....	895 0	... 456 0	... 1,351
R. S. Parker	897 0	... 449 0	... 1,346
Batchelor.....	874 0	... 448 0	... 1,322
Haynes.....	798 0	... 400 0	... 1,198

KINGSWINFORD.—For the erection of new Board Schools, Mount Pleasant, Quarry Bank, for the Kingswinford School Board. Messrs. G. B. Nichols & Son, architects, 59, Colmore-row, Birmingham. Quantities by the architects:—

Innes & Wood, Birmingham.....	£2,500 0 0
J. H. Bates & Son, Dudley	2,135 0 0
Love & Flint, Dudley	2,100 0 0
J. Dallow, Blackheath	2,060 0 0
C. A. Horton, Brierley Hill	2,050 0 0
Holland & Son, Dudley	2,050 0 0
J. Guest, Brettle-lane.....	2,050 0 0
Bennett & Son, Brierley Hill	1,998 0 0
W. Willetts, Old Hill.....	1,979 0 0
H. Dorse & Son, Cradley Heath*.....	1,850 0 0

* Accepted.

LINCOLN.—For pulling down bakehouses and adjoining cottages in Westgate, and the construction of a new bakehouse and warehouse on the site, for Mr. W. Blaze, from plans prepared and quantities supplied by Mr. J. Thropp, C.E., Lincoln:—

M. Hatcliffe, Horncastle	£560 0 0
Hunter & Son, Spilsby	510 0 0
Martin & Sims, Lincoln.....	448 0 0
S. & R. Horton, Lincoln	443 0 0
J. W. Harrison, Lincoln	419 0 0
J. M. Harrison, Lincoln	415 0 0
Chas. Robinson, Lincoln	415 0 0
J. B. Harrison & C. Robinson, Lincoln	413 0 0
H. S. & W. Close, Lincoln.....	400 0 0
Exors. of W. Wright, Lincoln*	349 0 0

* Accepted.

LONDON.—For masons' and paviors' work for the Chelsea Vestry for twelve months:—

Chelsea District.

Cooke & Co.....	5	per cent. below schedule.
Mowlem & Co.	10	,, ,, ,,
Treherne & Co.....	15½	,, ,, ,,
W. H. Wheeler, 11, Queen Victoria-st.*	15½	,, ,, ,,

Kensal Town District.

J. H. Neave.....	6	per cent. below schedule.
Mowlem & Co.	7½	,, ,, ,,
W. H. Wheeler, 11, Queen Victoria-st.*	7½	,, ,, ,,

* Accepted.

LONDON.—For alterations to business premises, 287, Edgware-road, W., for Messrs. Byford & Way. Mr. Thomas Durrans, architect, 44, Upper Baker-street:—

Whitehead & Co.....	£245 0 0
J. Butler.....	230 0 0
Harris & Sons	226 0 0
Drysdale (accepted)	196 0 0

LONDON.—For the erection of a lodge and alterations to cottages, Long Ditton, for Mr. C. L. Lavers-Smith. Messrs. Hammack & Lambert, architects:—

Williams & Son.....	£1,157 0 0
Jarvis	1,014 0 0
F. Peters (accepted)	855 0 0

LONDON.—For the erection of new warehouse, for Messrs. Batey & Co. (Limited), Kingsland-road, London. Messrs. Hammack & Lambert, architects:—

Drew & Cadman	£1,923	0	0
David King & Son	1,775	0	0
Williams & Son	1,733	0	0
Holliday & Greenwood	1,677	0	0
Ivory	1,598	0	0
J. H. Johnson (accepted)	1,593	0	0

LONDON.—For rebuilding house and premises, No. 25, Hoxton-square, for Mr. J. More. Mr. J. Linsell, architect, 92, London Wall, E.C.:—

Richardson Bros.	£1,538	0	0
Turtle & Appleton	1,487	0	0
Porter	1,480	0	0
Hewitt	1,385	0	0
J. Ivory (accepted)	1,360	0	0

PENGE.—For parish room, &c., for Rev. D. McAnally. Mr. Harold A. Kinder, architect, Suffolk House, Laurence Pountney-hill, Cannon-street, E.C. Quantities by Mr. Alfred Howard, 6, Martin's-lane, Cannon-street, E.C.:

J. & S. Bowyer	£2,395	0	0
Eustace & Sons	2,045	12	7
J. & C. Bowyer	2,013	0	0
J. Woodward	1,996	0	0
W. Fox	1,979	0	0
J. Hollingsworth	1,947	0	0
Bunting	1,939	5	7
H. R. Ockenden	1,925	0	0
T. Wootton	1,847	9	3
T. Batchelor	1,825	0	0

PRESTATYN (North Wales).—For the erection of a pair of semi-detached cottages, at Prestatyn, North Wales, for Mr. A. W. Jones. Mr. J. H. Burton, architect, Warrington-street, Ashton-under-Lyne:—

W. Williams, Rhyl	£918	0	0
W. Thornton & Sons, Liverpool	895	0	0
John Williams, Buckley	835	0	0
James Downham, Tranmere	810	19	3
Joseph Williams, Rhyl	789	0	0
John Mayers, Chester	771	0	0
Allen Holmes, Ashton-under-Lyne	765	0	0
Jones & Roberts, Rhyl	720	0	0
Griffiths Eames, Prestatyn	695	0	0
G. J. S. Jones, Rhyl	690	0	0
David Griffiths, Rhyl	625	0	0
G. & H. Wright, Kelsall	611	10	0

ST. LEONARDS-ON-SEA.—For partially rebuilding of and alterations at the Old Sussex Hotel, St. Leonards-on-Sea. Messrs. Elworthy & Son, architects. Quantities supplied:—

Harrison & Spooner, London	£5,867	0	0
D. Snow, Hastings	4,826	0	0
Comport, Northiam	4,675	0	0
Phillips Bros., Hastings	4,590	0	0
C. & E. Harman, Hastings	4,447	0	0
H. & F. Rodda, Hastings	4,375	0	0
H. Cruttenden, Hastings	4,213	0	0
Eldridge & Son, Hastings	4,200	15	0
Hughes, Hastings	4,200	0	0
Salter, Hastings	4,193	0	0
Eldridge & Cruttenden, Hastings	4,131	0	0
White, Hastings	4,122	0	0
Taylor Bros., Hastings	3,979	0	0
P. Jenkins, Hastings	3,595	0	0

[Architect's estimate, 4,208*l.*]

SOUTH KENSINGTON.—For decorations at No. 25, Nevern-square. Messrs. Morley & Letts, architects, 186, Earl's Court-road, S.W.:—

Toten & Sons, Gloucester-road*	£208	0	0

* Accepted.

WAKEFIELD.—For infectious hospital, &c., Carr Gate, for the Rural Sanitary Authority, Wakefield Union. Mr. William Watson, architect:—

Whole Tenders.

Wm. Johnson, Maningham	£3,100	0	0
Wm. Bissett & Sons, Sheffield	2,920	0	0
Kirk, Knight, & Co., Sleaford	2,869	4	6
Wm. Ives & Co., Shipley	2,828	14	0
Walter Binns, Bradford	2,740	13	3
John Schofield, Dewsbury	2,676	9	3
Jackson Bros., Goole	2,199	10	0
John Hall, Thorp, & Son, Leeds	2,157	0	0
J. & G. Summers, Wakefield	2,134	10	0
J. S. Flower Bros., Wakefield*	2,075	0	0

[Seventy-nine separate trade Tenders were also received.

* Accepted.

WAKEFIELD.—For residence, St. John's, Wakefield. Mr. William Watsen, architect:—

Accepted Tenders.

Excavating, Brick, and Stone Work.

Flower Bros.	£347	8	6

Slating.

C. F. Rycroft	21	0	0

Plastering.

Charles Driver	40	0	0

Carpenters' and Joiners' Work.

John Loyd	195	16	0

Plumbing, Glazing, Ironwork, Gas, and Bells.

Fred Mosley	100	0	0

Painting Work.

Thos. Naylor	10	9	6

[All of Wakefield.]

[Forty-three Tenders received.]

WAKEFIELD.—For rebuilding part of the Albion Mills, Ings-road, Wakefield, after a fire. Mr. William Watson, architect:—

Accepted Tenders.

Excavating, Brick, and Stone Work.

J. & G. Summers	£215	6	0

Slating Work.

C. F. Rycroft	68	10	0

Carpenters' and Joiners' Work.

N. Ibbotson	282	10	0

Plumbing, Glazing, and Ironwork.

Fred. Mosley	66	0	0

Painting Work.

Chas. Turner & Sons	7	5	0

[All of Wakefield.]

[Forty-four Tenders received.]

WESTON-SUPER-MARE.—For painting and decorative works at the Congregational Church, Weston-super-Mare. Messrs. Lingen-Barker & Cross, architects:—

Harris	£195	0	0
Poole	170	0	0
W. R. Palmer	134	10	0
T. Palmer & Son (accepted)	121	12	0

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